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ABSTRACT

Three essays are presented as part of a research project on education and the labor market. The aim of the project is to study long-term relations between education and productivity, with special attention to Swedish higher education. The first essay, by Mary Jean Bowman, deals with some broad issues in the philosophy and methodology of educational planning. The manpower approach to planning is evaluated critically. In the second essay, Asa Schlman surveys developments in Swedish education during the present century and tries to relate them to contemporary changes in labor market allocations and income distribution. The results of educational efforts are compared with stated political aims. It is noted that any such evaluation depends on the explanatory models given for interpreting data. The explanatory models used by economists are discussed by Bengt-Christer Ysander in the third essay. Critical comments are focused on the assumption of homogeneity, and the interpretation of the term "human capital." (Author/MSE)

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INFORMATION ON HIGHER EDUCATION IN SWEDEN

Learning and Earning

Three essays in the economics of education

by
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and
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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Preface

The following report has been compiled as part of the Swedish programme of research into higher education. This programme covers three major problem areas, *viz:*

1 the role of higher education in society,

2 higher education as a system: its structure and governance,

3 the internal work of higher education: the environment and working methods of research and teaching.

Work has also begun on a fourth problem area, namely R & D organization.

For some years now, continous reviews and problem surveys, research projects in the form of empirical studies, problem area meetings and research information services have been in progress within each of the three major problem areas. Together these acitivities make up a combined planning and retrieval process aimed at achieving problem analyses in greater depth and at defining the priorities which should be applied to future work and to the initiation of new studies. The current scope of the programme is described in a recently distributed information bulletin, *R & D for higher Education 1977:8.*

The present report, which comes within the first of the above mentioned research areas, has been prepared by Professor Beng-Christer Ysander and Research Assistant Åsa Sohlman of the Department of Economics in the University of Stockholm, together with Professor Mary-Jean Bowman of the University of Chicago. The conclusions and evaluations presented in the report are, of course, those of the authors themselves and not necessarily those of the National Board of Universities and Colleges.

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Foreword

These essays are published as part of a research project: "Education and the Labor Market", sponsored by the National Board of Universities and Colleges. The aim of the project is to study long-run interrelations between education and production with special references to Swedish higher education.

The first essay, by Mary Jean Bowman, deals with some broad issues in the philosophy and methodology of educational planning. In particular, Professor Bowman makes a critical evaluation of the so-called manpower approach as used e.g. by the Swedish educational authorities. Professor Bowman's essay was mainly written during her stay at the University of Stockholm in 1974-75; she has not had the opportunity to see the other essays before publication.

In the second essay, Åsa Sohlman surveys developments in Swedish education during the present century and tries to relate them to contemporary changes in labor market allocations and in income distribution. She compares the results of educational efforts with the stated political aims and discusses how any such evaluation depends on the explanatory models used for interpreting data.

The explanatory models used by economists are discussed in the third essay by Bengt-Christer Ysander, who focuses his critical comments on the assumptions of homogeneity. Some problems concerning the interpretation of "human capital", touched upon in this essay, are somewhat more rigorously developed in an appendix.

Bengt-Christer Ysander

I

Mary Jean Bowman

CHOICES BY AND FOR PEOPLE

Processes, goals and the search for congruence between the educational system and the economy

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Introduction

There is a natural tendency in this age of large-scale planning to seek to lay out public policies and programs that will produce a neatly ordered society. In that society all things would fit tidily together; by contrast actual societies display much disorder. Education enters into our lives in many ways, now and in the future. Education both affects and responds to economic structures and processes in complex patterns, and it is impossible to specify even conceptually full congruence between an educational and an economic system. Congruence cannot be observed and measured directly - least of all in a society characterized by continuing change. Indeed, it can hardly be said to exist independently of how we think about societal systems and their evolution. Nevertheless, the notion that planning should somehow bring about a better fit between school and economy has been and continues to be pervasive.

This emphasis on fit, or "congruence", between the educational and economic systems emerged initially during the first quarter century following World War II. It had two main sources. One of these was the "expert's" test of himself: internal consistency of planning models or programs was a value-neutral test of their respectability regardless of the fundamental purposes of constructing those planning models in the first place. More important, however, was the concern for smooth, balanced growth; stability in real life was to be sought, jerkiness and erratic swings or over-reactions, bottlenecks and surpluses were to be avoided. This second source of concern with fit or congruence illustrates, in turn, two distinct ways of looking at the meaning of congruence in societal systems: (a) stability in interactive processes whatever their effects, and (b) consistency of structures and processes with one or more societal goals - in this case with economic growth. Implicit also was the belief that economic growth would be enhanced by a smooth meshing of development gears rather than through a series of disequilibria with attendant pushes and pulls. It was in this context that interest in the economics of education spread so rapidly, linked as it was to assessments of what education could contribute to the national product and its growth. To quantitative planners, and forecasters of manpower requirements in particular, inducing a better "fit" between human-resource mix and demands for high-level manpower was a major concern. But an allocation of resources to formation of human capital consonant with demands was a concern also to assessors of social rates of return to educational investments. This preoccupation with

allocative congruence between the educational and economic systems persists today in spite of (or even, in part, because of) marked alterations during recent years in relative shortages and excesses of different sorts of human resources. The problems centering around how resources will be allocated in the formation and utilization of human capabilities will not disappear merely because there has been a dramatic expansion in schooling. Consequently I have devoted sections II and III of this paper primarily to just these questions.

The conventional allocative or productivity view of congruence between educational and economic systems is nevertheless far too narrow and too biased a perspective to serve well in the formation of educational policies. It is too narrow a view even if we examine, as we should, the related question of how well labor market policies may fit with educational developments. In fact other concerns have come increasingly to the fore. Wherever educational planning may begin, and however paternalistic or decentralized it may be, no thoughtful person today would stop with a specification of goals and a concept of congruence between educational and societal development that was limited to manpower "fits" or equalization of rates of return.

Most obviously, if we are to speak of congruence between educational and economic policies we cannot ignore considerations of equity or distributive justice. Fortunately, in my view, over the past two decades people and governments have paid much more attention to equity in the provision of opportunities for education than the attempts to obtain "fits" might suggest. Sweden provides an outstanding example. But the level of analysis of relationships between realization of greater equity and improved resource allocation has left much to be desired on both technical and philosophical levels.

Equally obvious, one would suppose, must be consideration of freedom for individuals to make personal choices about how they will lead their lives. It was efforts to deal with this gap in logic that brought the idea of "social demand" into the literature on manpower planning, but unfortunately without any theoretical or analytical framework, either positive or normative. The question of congruence in the demands for and supplies of education as a consumer good has all too often been dismissed as irrelevant when it has not been treated dogmatically as an asserted incongruence between the choices people make and the public interest. Closely associated with this has been the biased and narrow definition of monetary national product to which human resources are assumed to contribute. Orientation to people, insofar as it has been explicit at all, has taken the form of <u>planning for</u> people, with little regard to <u>choosing by</u> people. Olympic disdain for people and their choices is still pervasive among the makers of plans.

To state these basic themes is only a beginning. What about the many constraints derived from other societal values or from attachments that limit the range of permissible institutional forms, structures and processes? What, for that matter, is meant by "education", and what constitutes an "educational system"? Surely there is nothing new in the recognition that education is not just what goes on in schools. In a broader definition, education has long been identified with human development. None of this is changed by the slogans that have been spewed out in rapid succession: non-formal education, informal education, life-long education, recurrent education, and so on. So long as men strive for some sort of "congruence" in social policies - and this search for planned order and consistency is pervasive in an age of social engineering - more probing theoretical and philosophical examination of what congruence may mean is evidently of great pragmatic social importance.

It is for this reason that I attempt briefly, in Section I, to provide a broad philosophical context for the analysis of congruence in educational and economic policy in a society that, whatever its particular institutions, professes democratic values and respect for the ordinary man. Later in the paper, in Section IV, I deal at some length with "Freedom, Control and Opportunity". Along the way I hope to dispose of some prevalent non-issues, to direct attention to important neglected but real issues and to point to a few critical implications for educational and labor market policies.

1 Concerning congruence, systems and policy

Despite a considerable variety in social systems in the world today, some of them the outcome of revolutionary changes, no social system has ever been born from a utopian blueprint untrammelled by past history. Sweden today is no exception. Rather than constructing blueprints, which are always grossly oversimplified, it is more fruitful, therefore, to explore congruence in policies only as seen in the workings of existing or feasibly modified societies. I stress the process aspect of systems, for what is important is not the structure of a system as this might be charted in terms of identifiable units, lines of authority, and interaction. Rather, we need to look at how things are done, how flows of resources through the system and among its members are determined, how changes or adaptations in activities are made.

The Finnish scholar, J P Roos, has recently provided some illuminating and highly sophisticated insights into this complex sphere of social thought and practice.[1] "Policies", or "policy-making" by his definition is extremely rare, but it is also at the heart of planning and the implementation of plans. Thus Roos defines a policy as "a set of actions attempting at comprehensive, consistent and conscious guidance of the society".[2] Now it would seem evident that policy by this definition could be elitist and dictatorial, though however great the central power there must be systems of incentives (positive or negative) to induce the desired behaviour among a population. Roos specifies what he terms "inherent requirements" of policy:[3] (1) First, it must be "democratic, in the sense that it is related to the wishes of the people and that the people can effectively control its realization". (2) Second, "objectives and functions of a policy should be coordinated in the sense that they combine to produce the desired result". (3) Third, it must be "scientific, in the sense that co-ordination and control are based on scientific analysis, that is on a policy science. Here we should not forget, however, our first requirement: a true scientific policy is never undemocratic". (4) Fourth, "it should be obvious that social policies can never and should never be comprehensive, in the sense that they cover all activities of the people". I shall return later in this essay to a few remarks on Roos's discussion of problems of freedom, justice, and control - together with his observations on the problem of "how, in what way, and by whom is social welfare to be defined and realized on society?" There is one other, related aspect of Roos's discussion that is appropriate at this point, however. Roos rejected the "temptation to define

policy - as in decision theory - as a sequence of actions where first goals are defined, then means are selected, actions valued, and so on".[4] He agrees with Lindholm's argument that "this way of looking at policy-making is useful for some purposes, but it tends to view policy-making as though it were a product of one governing mind, which is clearly not the case".[5] And so we come back to the fact that what Roos terms the substantive, in contrast to the formal, goals of policy and criteria in the valuation of societal systems are formed endogenously even as they may also guide policies and subsequent societal developments. Viewed in this way, congruence between an educational and an economic system, like congruence among other elements of a total socio-economic system, implies wide consensus in acceptance of the constitutional foundations (formal or informal) of a society and of its guiding norms.

It would be inappropriate for me to attempt to set forth the guiding norms of Swedish society, but it may not be inappropriate to make two assertions. First, I take it for granted that Lincoln's famous words apply equally to Sweden: government is to be "of the people, by the people and for the people". This, in my interpretation, is the heart of Roos's requirement that policy be democratic. But, second, there is another element that I would regard as equally essential for true democracy: Roos's fourth requirement that plans should never cover "all activities of the people". A stronger way of stating this would be to reiterate the point I made earlier: democracy demands not only popular participation in collective decision-making but also ensurance of a wide scope for personal choices. But the degree of control men have over their own lives must clearly depend upon the productivity of the economy, the distribution of access to resources and productive opportunities, and the scope allowed for expression of preferences. It is both more and less than a system in which leaders attempt to identify preferences and then make decisions for people.

It follows that educational and economic policy-makers alike are challenged to identify ways to enlarge the mutual supportiveness among three major goals already discussed: (1) efficiency in production and in the allocation of resources; (2) equity in the distribution of opportunities and rewards, and (3) freedom of individuals to exercise choices in their own lives. The last of these is a necessary part of the first so long as it is people, not "the state", whose preferences determine the values placed on the components (monetary and non-monetary) of national output. Even a society so rich as Sweden cannot be free of dilemmas in conflicting goals, but satisfactory resolution of such conflicts must be far easier (and the conflicts themselves far less) than in less-advanced economies. Resolution will be easier, that is, provided that leaders in policy making continuously challenge themselves, taking fully into account the natural human tendency to believe that they know

what is best for others. It will be easier also provided they take the time to think through the ways in which productivity, equity and individual freedom can in fact be combined in a society that can afford relative affluence for all. This is not an argument for "laissez-faire". It is rather an argument for institution-building to enlarge the scope for self-fulfilment and for informed freedom of choice among the general populace. Attempts to restructure jobs so that there will be more satisfaction in doing them is entirely consistent with such purposes, but perhaps free tuition in institutions of higher education and restricted-entry faculties are not.

2 Concerning congruence, stability and economic growth

We have been living through one of the periods in history in which men have sought and expected far more from the schools than those institutions ever could deliver. Both the successes and the failures of school systems (and of education more broadly defined) have brought disillusionment for some, challenge to educational reform for many citizens. Notions of congruence of the educational system with the economy are colored by changing conditions, by newly perceived problems and possibilities, and by associated shifts in value priorities. Especially today among the "advanced" nations, there is occurring a marked shift from emphasis on growth to emphasis on distributive justice. Nevertheless, the first post-war concerns about meshing educational with economic planning were focussed on growth, and this emphasis continues in the reports of planning commissions even where distributive justice is fully as much in the spotlight of political activity and socio-economic policy making. Today we are seeing also the revival of an older concern about frustrated expectations among the enlarged numbers of new graduates from higher levels in the educational system. In this situation political worries intensify the concern with "fit" between human-resource demands and supplies. In the end this can bring us full circle, to a situation in which the search for "congruence" derived from concern with economic growth becomes inextricably entangled with the politics for distribution of benefits and opportunities. While the discussion here will focus mainly on resource-allocation aspects of congruence between education and national income goals, it cannot be limited to such considerations.

Perfect congruence and static equilibrium

Perfect all-round congruence among the parts of a social system, and hence of the educational with the economic system, is imaginable only in a state of static equilibrium. Even then we can speak of perfect congruence only in terms of accepted institutions and values, excluding postulated different futures for the society. Professor Schultz's "traditional agriculture"[6] represents such a static equilibrium; there have been many generations in which to work things out without the injection of disturbing elements. (There could be weather uncertainties, to be sure, and there could be random variations in the fortunes of individuals, but on the average expectations are fully realized.) Each part of Schultz's traditional system is adapted optimally to each other part within the confines of existing

knowledge and resources and of accepted societal institutions; no one challenges the political or social order, and there are no "incongruities". This image of perfect congruity occurs, albeit with different terminology, in many of the older studies by anthropologists, who emphasized the stability and the tight webs of interdependencies among the elements of the societies that they studied. But whether we regard a society in static equilibrium as totally an abstraction or as approximated in some societies, the perfect congruity of the parts could mean very different things in one substantive context versus another. Starting from matters that evoke widespread concern and argument among policy makers, planners, and social scientists around the world today, a list of dimensions of congruence in the static equilibrium case looks something like this:

(1) Things having been worked out through a long past, there remains no way in which, within the rules, individuals could improve their prospects by changing their decisions. Given their resources, the state of knowledge, and accepted institutions, production and the allocation of resources is efficient. This assumption includes allocation of resources to the transmission of knowledge from one generation to another, but the static assumption precludes creation of new knowledge. There will be no discrepancies between manpower demands and supplies.

(2) As a corollary of (1) there is no systematic bias in failures to realize expectations. Systematic incongruence of educational choices and expectations with what education will in fact accomplish is impossible.

(3) Distribution of opportunities in this society is constant, but this does not necessarily imply that there is an absence of social mobility. The static-equilibrium society can provide for a wide or a narrow range of status inequality and rates of status turnover among families and individuals. For the same reasons, the distribution of income and wealth may be more or less unequal, and individuals may shift their positions in the distribution easily or rarely, but the overall distribution remains the same.

(4) Without injection of some new element into the situation, which was excluded by definition, there can be no economic growth. The perfect congruence of the static equilibrium system is thus <u>incongruent</u> with economic development or modernization.

More generally, the perfect congruence of a static equilibrium state is incompatible with societal change or with change in the overall distribution of opportunities, income, and wealth. There cannot be any shift to a more (or to a less) mobile status system for any given distribution of status positions. There will be no talk of "alienation". Static congruence may give great or little scope for free expression of the preferences and wishes of individual members of the society - for economic democracy in decision making - but it is incongruent with changes in this

respect. Yet all of these sorts of change have been of rising concern in one or another part of the world, and relationships between educational and economic systems are involved in every one of these changes. Furthermore, growth has come to be seen as a very real process and has come to be accepted almost universally as a societal goal. The perfect congruence of the static traditional model is not very interesting; clearly it is not what people have in mind today in speaking of congruence.

Congruence and steady-state growth

If for the moment we confine our attention to growth and disregard other features of socio-economic systems, we can make an easy transition from the notion of static equilibrium to that of a steady-state moving equilibrium: the theoretical economics of "golden-age growth". This could give us perfect synchronization of all elements of change in full conformity with a long-term path or with equilibrium growth; there are neither disturbing oscillations around that path nor explosive breaks away from it. If attainment of such a steady equilibrium growth is regarded as a prime goal, then the congruence it entails is of course a congruence to be achieved in as high a degree as possible. Implicitly, such a view of growth processes has underlain the literature on manpower planning, although most of those who have called themselves manpower planners have striven to be more empirically pragmatic than theoretically elegant.

One of the main sources of concern with the notion of "congruence" has in fact been the discomfort of manpower forecasters who have been trying out the predictive powers of their models and worrying over the looseness of "fits" that they observe. However, that concern does not necessarily challenge the notion of a steady-state moving equilibrium. It may be instead that there was a misspecification in the manpower models, which have tended to be technologically rigid, leaving little or no room for substitution and for associated adjustments through the price system. Or it may be that short-run disparities are an unavoidable concomitant of rapid economic growth.

Congruence and growth in the longer and shorter runs

A more fundamental challenge strikes at both benefit-cost accounting (social rate-of-return analysis) and manpower planning as these usually are set forth in principle as well as in practice. This challenge is thrown up in the "big push" as against the "balanced growth" theories, or indeed by any interpretation that stresses the importance of shock effects or of disequilibria as forces generating development. Regardless of whether the sources of the impact are perceived as exogenous or as produced endogenously by disequilibrating forces

within the system, it is evident that the identification of congruence or lack of congruence with growth is now a much more complex matter, both conceptually and in empirical assessments. The more dynamic the system and the greater the pace of change in any of its sectors, the more elusive the concept and measurement of congruence becomes - but also the more challenging to policy.

There has never been a society in which there has been at once rapid progress and also smooth transitions without major short-term problems of adjustment in adaptations of some parts of the development process to others. The search for congruence in growth is an attempt - almost surely futile - fundamentally to change the nature of dynamic processes. But there can be no doubt that a sustained demand in the market for large numbers of well-educated men and women is dependent upon a process of sustained technological and organizational change. This is so because it is change itself that calls upon our powers of adaptation and capabilities for complex decision-making, which in turn are a major part of what education contributes to a man's lifetime productivity. Turning the usual "congruence" question around, only a continuing high pace of innovative activity will provide the conditions for full and efficient utilization of a continuing flow of highly-educated manpower. The availability of such capabilities in the population is undoubtedly a spur to continuing innovation and supports those sorts of innovation that in turn make use of high-level skills. Nevertheless, a close matching of technological and organizational innovation with the stocks and flows of high-level manpower may become increasingly elusive as the stock of highly-qualified persons increases. Some components of a development process are more easily planned and controlled than others. For example, despite the fact that the so-called "social demand" for schooling may seem to have "run away" in some nations of late, a determined society could control the pace of diffusion of schooling far more easily than it could control the extent and forms of technological innovation or the accumulation of know-how through experience at work. These problems differ substantially in their nature and magnitude among societies that are at different levels of economic or educational advance; one cannot compare Sweden with Pakistan or Venezuela with Zambia. Perhaps many countries should put other sorts of progress ahead of growth. But the fact remains that if what is sought first of all is a rapid pace of economic advance, economic and educational policies conducive to such growth will produce major short-term imbalances.

Partial specifications of congruence and incongruence

It becomes increasingly clear that the notion of congruence of an educational system with an economic system can be given pragmatic content only when we specify the relevant economic processes and what aspect of the economic system

and its performance is under consideration. Even when only productivity (or social efficiency) is being considered without any concern for such important questions as equity in distribution, the meaning of "congruence" may elude us, together with specification of conditions for its realization. One alternative is to pick out smaller problems, one at a time, and then fit the pieces together in various combinations by iterative approximations. But to specify congruence in these partial settings may be more limiting than is necessary; it may be both easier and more fruitful to begin by considering what would and would not necessarily be <u>incongruent.</u> In any event we should examine some of the common fallacies or distortions in perceptions of incongruence.

To illustrate, I list first some things I would regard as not necessarily incongruent with a national-product criterion (although often so regarded) and second some situations or policies that clearly are incongruent with that criterion though widely approved. Among the former are these: (1) pursuit of education for the fun of it; (2) freedom to choose preparation for jobs or skills not in strong demand or not counted as important by manpower-requirements forecasters; (3) intra-generation shifts in jobs and retraining of adults; (4) wide diffusion of primary schooling regardless of rural-urban migration. I see as <u>not</u> congruent with the economics of growth (1) a policy of pouring public resources into expansive vocational schools the graduates of which transfer into non-technical jobs - having attended the vocational course as the remaining option because of restricted access to more general education. (Fortunately this phenomenon seems to be diminishing in importance in the less developed countries, for the double reason that educational budgets are strained and that the rising popular demand for general schooling has bypassed expensive vocational training at the lower levels of the system.) Also incongruent is (2) a system whereby higher education is made costless to the individual (often with substantial stipends for comfortable levels of living during the college years) even when youth coming out of these institutions are waiting in long queues for jobs. (3) Obviously incongruent from a strictly growth perspective, though increasingly frequent, is the piling up of more and more schooling undertaken for career purposes where the spread of schooling already has moved ahead of absorptive capacities for graduates. More subtly, (4) it is unambiguously incongruent with economic growth to set high minimum wage rates for young people (or other new workers) without countervailing subsidies to encourage investment by employers in both formal and informal sorts of training on the job. Why these items were put on one list or the other will be discussed later.

3 Quantitative planning and the formation of human resources

It is no accident that concern with "congruence" and with adaptations of educational curricula to demands of the economy has been expressed primarily by manpower planners, since typically they start from quantitative measures and occupational structures. Attempts to identify the sources of unexplained growth ("the residual") in aggregative econometric models and in national-income accounting have specified education embodied in the labor force only by levels, not by types of curricula. And the rate-of-return approach of neo-classical economists leads to assessments of allocations to investments in human resources in benefit-cost rather than quantitative terms even when types of curricula are distinguished. Indeed, given its quantitatively oriented origin, the term congruence as it has commonly been used must go through a metamorphosis before it can be fitted into the neo-classical models; congruence is then specified by equalization of social rates of return to investments in education or, more subtly, Pareto optimal allocation in the formation and utilization of human resources. Only the manpower models attempt to make quantitative assessments of fits or misfits between demands and supplies by skill categories. It is appropriate, then, that we look first at the "manpower approach" in considering the search for "congruence" between educational programs and the human-resource demands of a growth economy.

Key features of the manpower approach

The essential features of that approach must be understood if we are to grasp why manpower planners have been so concerned with "congruence" or with adaptation of the educational system to the economy. Manpower-requirements analysis has often been identified with "input-output" analysis, with which it does indeed have features in common that distinguish it from neo-classical models. However, conventional manpower analysis has also been criticized as a badly misguided application of input-output methods. The best statement on the standard manpower approach by people who have participated in its applications and testing appeared in a 1970 O.E.C.D. report. Since I have challenged manpower analysis on a number of occasions, it may be desirable to quote the erstwhile proponents:[7]

> The manpower approach to the quantification of the economic objectives of education starts with projec-

tions of output, productivity and employment by sector of economic activity, goes on with the projection of the occupational structure of sector employment, its translation into educational equivalents, and ends by calculating the number of new entrants by level and type of education required for the labour force during the projection period. The methodology used so far, including the O.E.C.D. one, is a multi-stage approach as opposed to a simultaneous and optimal-solution approach ...

In this context, the multi-stage approach means that the production function (with two traditional factors of production, capital and labour) has already been decided upon when the manpower--educational planner comes on the scene. The production function being used does not interest us for the moment. ... The important point is that, in one way or another, the amounts of output, capital and labour have been fixed before the manpower planner starts on his work. Those who work with Leontief concepts at this stage are closest to the manpower projection methods as used at present. Indeed, the manpower planner maintains that, once he knows the production function, and thus labour and productivity, he will be able to determine the occupational and educational structure of that (already fixed) labour force at the level of technology implicit in the production function. He, therefore, assumes complementarity and technological relationships - a Leontief universe. But though the manpower approach as currently practised consists of a series of successive approximations, one could very well imagine a simultaneous solution applied to it, as long as one is prepared to draw the theoretical consequences from such a procedure. ... at its extreme, the method consists in assuming that to each factor of final demand corresponds one, and only one, occupational and educational structure which fulfils the condition of a simultaneous solution.

Two key elements of this statement must be stressed. (1) In purpose this is a planner's model; explanation, if any, must occur in the production-function stage, before the manpower planner comes on the scene. (2) The determination of both manpower requirements and derived requirements for education is completely technocratic; elasticities of substitution are zero and there is no place for the operation of price incentives. One of the correlates of these features of the model is disregard for determinants of supplies of qualified manpower. There is a disregard also of how education may affect productivity; in fact the model produces lower estimates of derived educational requirements the higher the

starting estimates of increase in productivity. The empirical usefulness of the model depends critically on existence of extremely low elasticities of substitution among identified sets of skills or among categories of educated manpower, on near--zero elasticities of substitution between categories of human resources and physical capital, and above all on the accuracy with which the fixed input-output coefficients can be identified in a growth context. Variants of manpower planning relax the inelasticity assumptions in various ways, but they remain quantitative in character, without pricing or any sort of decision theory.

A few undisputed facts

Obviously if one is going to make "quantitative plans" in the conventional meaning of that phrase, it is desirable that estimates of requirements for manpower be accurate and disaggregated. Accordingly, a major empirical enterprise among manpower planners has been to explore associations between national income and the structure of the labor force - by sector, by occupation, and by level of education.

Starting out in search of the "right", presumptively fixed, coefficients for estimation of "manpower requirements", manpower economists pioneered the collection of invaluable cross--national data about education-occupation-per capita income relationships.[8] Among their findings the following are of particular interest:

(1) There is a very substantial unexplained variability from one economy to another in the relationship between per capita incomes and educational characteristics of individuals in the labor force. At the same time there is great diversity among countries in the amount of educational variability within each "occupation".

(2) Statistical prediction of associations between levels of national income and characteristics of the occupational structure leaves substantial variance unexplained, but these correlations are much higher than those between national income and the educational characteristics of the labor force. Some years ago Harbison and Myers made the discovery, important for policy, that among nations the distribution of university students by subject of study was virtually uncorrelated with level of national income. However, as national per capita income rises the proportion of the labor force employed as technicians, scientists, and engineers rises. In the O.E.C.D. study already cited, results are similar. Correlations between various indicators of level of national income and of technology and proportions of the labor force in professional, scientific, and technical employments ran from .74 to .92 for the economy as a whole, implying coefficients of determination from .55 to over .80. Interestingly enough, the manpower contingent regarded even the 80

per cent as "low", whereas those who had been challenging the manpower analyses regarded some of these figures as impressively high. However, when relationships were examined within industrial sectors, even the associations between occupational composition and national income level or worker productivity were very weak, in most cases accounting for less than a fourth of the variance. (Manufacturing was a partial exception, with somewhat higher correlations.)

(3) Associations between levels of national income (or of technology) and within-occupation educational composition of the labor force were generally insignificant. The strongest observed relationships were in administrative and sales occupations, for proportions of workers with eight or more years of schooling; these coefficients of determination were .46 and .48 respectively. The next best prediction was for proportions of craftsmen and manual workers with eight years' schooling, a coefficient of determination of .35. Predictions for proportions in any occupation who had college education were in all cases insignificant and were erratic even in sign.

What do these results indicate about "congruence" between an educational system and economic growth? First of all, these data are not directly related to growth at all, but rather to the association between attained levels of economic and of educational variables. There is no clue to the nature of growth processes or to the role of education in them. What we observe are still-photos taken at various stages in economic and educational development of societies that themselves may vary both in degree of dynamism and in lead or lag relationships between educational and other developments. In some situations educational investments may be supporting further growth, in some education may be a drag on progress, and in some education may have moved ahead of the absorptive capacities of the economy; deviations from regressions based on cross-section data tell us little about these leads and lags in growth. Nor do these aggregative and imprecise data tell us anything about the quality or content of the education that has been embodied in a labour force.

It is not surprising under these circumstances that the most impressive empirical finding is simply that there is a very wide range from one society to another in association between education and level of economic attainment. If that is all we ask in seeking for "congruence", the stipulation is quite undemanding; it permits a wide latitude before hitting the bounds that mark unambiguous failure of the educational system to fit with any given level of economic attainment, let alone with any given stage and pace of growth. But neither manpower nor neo-classical economists have been ready to settle for so vague a prescription.

One response in which manpower planners and neo-classical

economists interested in identifying elasticities of substitution have joined has been to attempt more precise specifications of occupations and their comparability, but further disaggregation along these lines has not altered the findings.[9] Usually little attention has been given by either manpower or neo-classical economists to making sure that designations of education are as comparable as possible in cross-national studies, despite references to the "problem of differences in quality of education". There is one unpublished exception: Stanley Nollen (1971) introduced adjustments to specify completion norms rather than years of schooling in an attempt to reassess elasticities of substitution among education categories (and also among occupations) using cross-national data. Nollen challenges the extremely high elasticities estimated by Samuel Bowles,[10] primarily because of the basic econometric bias in Bowles' analysis. But Nollen's principal finding is still a low correlation between relative quantities and prices across societies, which precludes estimation of elasticities of substitution. The authors of the 1970 O.E.C.D. study summed things up objectively:[11] "The analyses carried out in this study ... strongly suggest that possibilities of partial substitution between different types of labor exist at given levels of economic and technological development ... other reasons besides substitution possibilities may exist to explain our findings, but the least one can say is that they cast serious doubts on the complementarity hypothesis adopted in manpower forecasts."[12]

Supply effects and "the identification problem"

Ever since Robinson Hollister's evaluation of the Mediterranean Regional Project (1967), there has been an uneasy awareness among O.E.C.D. staff of the fact that the educational composition of the labor force in general and in various industrial sectors and occupations results from interaction between demand and supply. In the 1970 study, failure to take such interdependence explicitly into account is cited as "a basic weakness of the usual manpower planning methodology", with its "focus on what might be called the demand effects to the exclusion of supply effect". In an attempt to correct for this bias, the O.E.C.D. study tried out a set of log-linear equations as follows:

(1) $L_{jk}/L = f(n)$

(2) $L_{jk}/L = f(L_j/L)$

(3) $L_{jk}/L = f(L_k/L)$

(4) $L_{jk}/L = f(L_k/L, n)$

(5) $L_{jk}/L_j = f(L_k/L, L_j/L)$

where L is total numbers in the labor force, n is an index

(actually various indicators were used) of per capita national income or national level of technological advance, L_k is number of persons in the labor force with schooling attainment k, L_j is number in occupation j, and L_{kj} is number in occupation j with education k. Some of the results have already been indicated in earlier paragraphs; equations (1) and (2) explained relatively little of the variance, though there were exceptions for some L_{jk}. With respect to equation (3), in the authors' words:[13] "the correlations, which are in many cases excellent, confirm the value of the educational structure of the labour force as an explanatory variable for the levels of education of the different occupational categories". In equations (4) and (5) they found that for[14] "the vast majority of cases the influence of the available supply (the "push" factor) strongly prevailed". It was evident enough that treating these findings in a growth context, rather than as a description of short-run relationships, there was a serious identification problem: again using the words of the O.E.C.D. authors,[15] "part of the influence of the 'needs' of the economy (n or L_j/L) is, in fact, contained in the educational structure of the labour force (L_k/L) and/or vice versa".

By now few will challenge the proposition that associations between average level of educational attainment in a population and average per capita income reflect two distinct processes. More education embodied in the labor force contributes to economic growth (or, in manpower language, is "required" for growth), and higher levels of income may lead to the allocation of more resources to education - whether as an investment or a consumer good. C Arnold Anderson and I underlined this ambiguity in interpretations of international data back in 1960[16] using crude reverse-lag single-equation estimates, but more elegant econometric models have not resolved the problem of identifying unbiased coefficients in underlying structural equations based on international data. On my reading of the facts, this problem cannot be resolved without introducing lag models, if then. Furthermore, we should recognize that development occurs in historic, not abstract, time.

Sorting out causal relationships is no less important for policy merely because it is difficult, and in fact we do this in one way or another, even if only by assumption. Human-capital theorists have been inclined to concentrate on education as an input and hence on the education-to-income effects, ignoring the income-to-education direction of effects, with often biased results. Manpower planners have been more inclined to treat the diffusion of education as a consumer response to higher incomes (when they seek to explain it at all) and as such it is often considered a non-economic and even an economically dysfunctional constraint on directing educational policy toward growth. This latter sort of thinking is the source of popular usage of the term "social demand"

when what is meant is private or personel demand, assumed to be unrelated to economic investment incentives; it is a source also of inflated non-issues, reflecting quantitative thinking without regard to incentive structures or to benefit--cost relationships, public or private.

A puzzle and a turnaround

As soon as manpower economists began to be concerned with elasticities of substitution as well as with demand shifts in their study of "manpower requirements", wage rates had to be brought into the picture. Meanwhile, the attempt to press further with empirical analysis of the mutual interactions between demands and supplies of qualified manpower in the growth process (the "identification problem") leads inevitably to a deeper consideration of what determines supplies of human resources. Thus it becomes necessary to examine human-investment decision theory and its applications. The types of statistical analysis tried out by O.E.C.D. and even that suggested by Malinvaud[17] are clearly no more than first steps in this direction, for they lack any theory of human investments. This is not the place in which to sum up and assess recent work in the elaboration and application of human-investment theory. Rather, I comment briefly on some events in post--war labor markets that may call for some fresh thinking on all sides.

First is a widely cited "puzzle", discussed most frequently in the United States but observed in other industrial nations as well over the 1950s and 1960s. How could it be that despite rapid increases in numbers of college graduates their relative earnings and the rates of return to the cost of their college education remained so stable? The data would seem to contradict established generalizations that decreasing returns follow substantial increases in the proportions of college-educated persons in the labor force.

One interpretation of this stability in relative wages and rates of return has focused on the supply side: a high degree of sensitivity to market prospects in the making of educational decisions will lead to supply adjustments that prevent rates of return from deviating in any major degree from equilibrium levels. However, even if there were such alert and accurate responses in human-investment decisions, the question would still remain: what explains the fact that so many new college graduates could be absorbed over so long a period at continuously favorable relative wages? Several forces that were unquestionably at work in the industrialized nations over this period must have contributed to these results. A continuing high rate of technological innovation sustained the demand for people whose education had equipped them to adapt quickly, to learn rapidly at work, and to participate efficiently in the decision making that is essential for success when confronted with a

rapid succession of changes. Increased numbers of well-educated men and women both made this pace of change possible and contributed thereby to creating demand for additional qualified people. Unquestionably there was also a tendency for innovations in a highly-educated society to be biased technologically in favor of (complementary with) the sorts of skills that are embodied in recent graduates of upper-secondary and higher schools. Shifts in the mix of consumer purchases associated with higher incomes may have favored goods and services with large top-skill components in their production, though a priori reasons for suspecting such a shift are less clear.

There were some nations, notably among the "less developed", in which sustained high relative wages of college graduates were an artifact of civil-service policy, however, rather than a reflection of shifts in labor market demands in favor of well educated people. Also, in a few countries over the decades of the 1950s and 1960s the relative wages of secondary graduates and then later of university graduates definitely declined. Provision of more educated people does not offer any guarantee that the economy will change to absorb them at previous salaries. This fact became evident even in the more dynamic and advanced economies in the early 1970s.

We are faced now with a turnaround in labor markets that is the more painful in that it is associated with general recession; this association is not accidental. A slower rate of investment in physical capital implies lesser potential demand for people who are qualified to meet the requirements of continuous change at work. But that is only part of the problem. The pace of increase in the college--trained as a proportion of the labor force increased greatly in the late 1960s and early 1970s due to the swelling numbers of college-age youth (the post-war baby boom), even without rising rates of college attendance in each successive age cohort. We observed also an accelerated democratization of education beyond the compulsory years - especially striking in Sweden. On all sides worries have arisen about excess, or incongruities, between the output of university graduates and demands for their services. The dilemmas for policy are aggravated by the fact that criteria for democratization of access to post-compulsory education now appear to be in conflict with criteria of efficiency in allocation of resources to investments in people as means to maintain and raise the national product. This problem is perceived very differently, however, from one advanced country to another. A contrast between Sweden and the United States holds illuminating lessons for both these and other nations.

In the recent past Sweden stood out as exceptional in the narrow range of occupations entered by its university graduates; entry to other than high-level occupations was rare. Even the proportion entering modest white-collar jobs was low compared with most other countries, and virtually none

were in manual employment through the 1950s and 1960s. In the United States, by contrast, almost a third of the four-year university graduates worked in sales and clerical occupations. In Japan this proportion was two-fifths. Where a situation resembles that of Sweden, there can be a severe shock of frustrated expectations, even though the occupational destinations of new university graduates would look quite enviable to youth in other lands. Moreover, in Sweden the marked increase in proportions of workers with secondary and college education was due not so much to a demographic shift as to sharp rises in enrolment rates. The socio-economic status composition of American college students had been broad for a long time and did not change substantially in the 1960s, whereas there was a substantial alteration in proportions of Swedish university students coming from "ordinary" homes. The politics as well as the economics of educational debate may be better understood against these backgrounds.

Even in the 1950s and 1960s, adjustments were not in fact as smooth as the aggregative observations might have suggested. In analysis using finer categories of training, considerable fluctuations in estimated rates of return to some sorts of training were found; at the extremes, in the United States estimated returns for some fields of engineering were highly volatile, while rates of return to training as a physician were constant. The quick adjustments of students' decisions to changes in demands for and earnings of young engineers has been well documented; there were in fact rapid swings back and forth in numbers of engineers trained and hired as well as in their relative earnings.[18]

Unfortunately, there is no simple, unambiguous inference for educational policy to be drawn from the events of the past two or three decades in the industrially-advance nations - even setting aside situations in less developed countries. However, some pertinent facts are unambiguous. The largest fluctuations in demands and supplies for high-level manpower have reflected actions of governments; it is the stop-go federal space and military programs that brought about the big swings in demands for certain kinds of engineers and the resulting student responses to market shifts in the United States. Furthermore, publicly sponsored guidance programs have contributed to periodic over-reactions in both directions among youth shifting toward and away from engineering courses (particularly in certain sorts of engineering). If smoother and less rapid shifts in these markets are to occur, policies must become more stable. "Restricted entry" faculties could constrain swings in supply, but only, in the situation of recent years, at the cost of sustaining a significant gap between demands of the government for space engineers, for example, and the numbers of qualified men available to meet the government's manpower "requirements".

Setting aside the engineers' case and other swings created by government policies, what can be said concerning educational and manpower planning for smooth growth and adjustments in a dynamic industrialized society? Would short-term, and long-term, incongruities or mismatches in labor market be damped if there were a finer mesh of curriculum and production planning with controlled enrolments in certain faculties? There is little reason to expect that this would work; indeed, if we are to judge from experiences where such controls have been attempted, new problems seem to have been greater than those that were solved or prevented. Nor can the anomalies and frustrations of the recent "turnaround" be met by a policy that combines restricted with cheaper open faculties. If incentives are weak enough there will be a voluntary reduction of enrolments without any special attempt directly to control them.

If sufficient incentive remains, the restriction of enrolments in part of higher education will simply channel youth who fail to get into the preferred faculties into the open ones. What follows is distortion in labor markets with exaggerated depressive effects in markets less protected by "unions" or "professional" restrictions. Specifying enrolments in all faculties rigidifies the system, and must be suspect in view of the now-familiar difficulties of manpower forecasting; moreover, detailed manpower forecasting ignores the fact that training for flexibility and efficiency in subsequent learning and for adaptation during the working years is a crucial aspect of forming human resources for growth and change. Total quantitative control, in general or in detail, is an extreme policy in any case, once consideration is given to either roles of individuals in making their own life decisions or to democratization of access to educational opportunities.

There could be policies, however, that would damp swings in the rates of college attendance or of attendance in particular faculties - policies that would be more easily implemented in a centrally controlled educational system such as that of Sweden than in a diverse and decentralized system. An analogy might be drawn with the stock market rule that limits the percentage increase or decrease in the price of a stock in a single trading day. If smooth adjustments are taken to be important (and more congruent with a sound long-run economic and educational policy) it would be possible to limit the amount of shifts in enrolments allowed in a single year or even in a few successive years. But this policy again is possible only in a society that accepts highly centralized controls, however benignly paternal. Another, perhaps preferable, possibility would be to modify the ways in which educational costs are distributed or shared. But to bring up these possibilities is to anticipate some dimensions of "congruence" (or incongruence) between educational and economic systems and policies that can be satisfactorily discussed only after consideration of the meaning of "excess and shortage", of the life-time paths of working and learning, and of issues relating to equity, freedom, and control.

4 Freedom, control and opportunity

Human thought always simplifies selectively. Unfortunately, these simplifications, though unavoidable, constrain our thinking and raise up false issues to confound us. Moreover, simplifying assumptions can have profound implications for policy that may reflect not so much the assumptions themselves as the modes of thought in which they were initially rooted; those roots condition the search for alternatives when initial simplifications appear no longer to be tenable. As a first step toward better understanding of some of the conflicts of values relating to difficult problems of freedom, control, and the distribution of opportunity it is useful to re-examine some aspects of manpower compared with human-investment economics and related interpretations of "excess and shortage".

Common and disparate features of manpower and human investment theories

Both the conventional "manpower" and the "human-investment" analyses of education are concerned with the mix of different sorts of human resources, and both make use of concepts of equilibria and disequilibria. They differ, however, in some basic ways of looking at society, and in perceptions of the rationality and wisdom of ordinary men.

To start with, most of the manpower studies were oriented to central planning, whereas the primary concern of human-investment economists was with the operation of relatively free human-investment and labor markets, however imperfect. It is only as benefit-cost (rate-of-return) analysis is brought to bear on collective decisions that these quite different lines of work come face to face. Even then there has been the gap between project evaluation within a broad market context (the usual application of rate-of-return evaluations) and more global manpower planning. The choice of zero or infinite elasticities of substitution as the initial simplification is much less important in itself than commonly is assumed. But it is significant that the assumption of zero elasticity fits the needs of quantitative planners, and it is a particularly congenial assumption when the market system is not merely ignored but is regarded as so exploitative (if it works at all) as to be an unhelpful guide to the allocation of resources. The "infinite elasticities of substitution" that constitute the starting point in most rate-of-return studies are convenient first approximations for micro decision theory in analysis of the behaviour of indi-

viduals and firms each of which is small relative to the total. However, where effects of very substantial changes are being assessed, other elasticity assumptions are needed for both private and social accounting; thus far the use and testing of such assumptions has been exceptional.

Second, manpower and human-investment economics differ as to the determinants of supplies of human resources. Human--investment economics emphasizes that supplies of human resources reflect investment responses of individuals (and firms) to economic incentives for schooling and for learning at work. By contrast, manpower economists typically have treated human-investment decisions as in some sense "social" as distinct from "economic". This contrast in perspective can be of paramount importance in the development of strategies for education because it implies very different views of what motivates people to stay longer in school or to start working. The underlying contrast is related also to degree of faith in the economic common sense of ordinary people to respond to clear incentive signals, as compared with faith in the ability of central planners to project the future and to make choices for the people in their best interest. But the assumptions about response or non-response of individuals to economic incentives in their educational and curriculum decisions can be and have been tested and the findings from empirical testing of private rate-of-return analysis can be as important to the management-oriented central planner as to the most laissez-faire economist: successful central management depends on understanding what is being managed - in this case peoples' choices of schooling and jobs.

Third, while both manpower and human-investment economists take time into account, they do this in very different ways. Manpower planning concentrates on aggregative demands for variously qualified people up to a given future planning horizon. There is nothing inherently inconsistent with rate-of--return analysis in this approach; indeed, the manpower--requirements and human-investment approaches should be complementary. But manpower economists have rarely thought in terms of the life span of individuals; the orientation has not really been to people. By contrast, human-investment economics (which is much broader than "rate-of-return analysis") has been concerned with how alternative income streams that stretch into the future may be affected by decisions taken in the school years and by decisions taken sequentially through working life. Those sequential decisions, with their associated time perspectives, may be made by individuals with respect to investments in themselves or by firms with respect to investments in employees. In either case, investments in learning do not cease when the individual passes through the portals of a school to enter the labor market. The educational system in a broad sense and the labor markets are very closely interwoven, not only in formalized training and apprenticeships but also in access to and choice of informal learning-by-doing at

work. Moreover, because of the career-development perspective over time in human-investment economics, increasing attention has been given to the effects of earlier investments upon efficiency in subsequent learning. The now-fashionable talk among educational and manpower planners about continuing or "life-long" or "recurrent" education is not, to the human--investment economists, a new idea. Much has been happening spontaneously (whether in formal or in informal ways) in this area of education. The importance of this perspective for any analysis of "congruence" between an educational system and the economy should be obvious.

Meanings of ''excess'' and ''shortage''

Specification of excess or shortage, whether conceptually or empirically is a much more difficult and subtle thing than might appear at a first glance. Short-term indicators that equate unemployment with excess and job vacancies with shortage can be misleading. Nevertheless, where there is persistent unemployment of (or persistent unfilled demand for) particular categories of human resources, as in the widely discussed "educated unemployment" in India,[20] something would appear to be definitely wrong. The first response of a manpower economist to such a situation is likely to be that too many people are being allowed to go through the higher institutions or that they are taking the wrong curricula (or both). Almost never will he raise any question about tuition policies or subsidies that encourage "too many" young people to attend college. Instead he says that the gate keepers of the educational system should more carefully regulate places and flows.

The human-investment economist, when faced with "educated unemployment", will ask: why don't the wages drop, how elastic or inelastic are demands, how do these college people sustain themselves while refusing to do less skilled work, and does it pay them to wait? In other words, what leads people to behave as they do? If "educated unemployment" has persisted for some time he will ask, further, how it happens that under these circumstances young people continue to flood into the colleges. What are the private, in contrast to the social, costs of their higher schooling? What are the private net benefits? Are private rates of return to investment in college education favorable despite high rates of unemployment or long delays in finding a satisfactory job? If there are persistent job vacancies, he will ask similar questions, though some will be reversed.[21] In either case, his questions will point directly to the operation of economic incentives as determinants of behaviour, both in labor markets and in the educational system. He emphasizes the dubious utility of subsidies to higher education under these circumstances, and he examines inefficiency and rigidity in the labor markets.

Another preliminary indicator of long-term malallocation of investments in college education, or (according to the evidence) in particular types of college and university training, will have been introduced by the neo-classical economist. His measure will be discrepancies among social rates of return to different investments in the formation of human resources and discrepancies between estimated social rates of return to such investments and to investments in physical capital. The private rates of return are incentive indicators, not indicators with which to assess allocative efficiency. And because manpower planners and human-investment economists typically start from different models of the economy, their recommendations for policy are different. The former recommends tighter gate keeping to achieve "congruence" of the educational system with the economy, by direct control of places. The latter suggests a change in the financing of education so that the signals for private action will be more nearly in line with social costs and benefits. The former is in the mode of paternalistic planning, the latter in the mode of incentive planning.

These observations illustrate why there need be nothing necessarily incongruent with economic efficiency or with economic growth in an educational system that requires full--cost tuition - at least from those who could afford it. But congruence in terms solely of allocation of resources to the production of human capital as a productive agent is a very incomplete way of looking at congruence between the educational system and the economy - even within a shortage--excess framework.

Earlier in this paper I asserted that there is no necessary incongruity with economic efficiency in a situation in which individuals choose to go to school for the enjoyment of the education (present and future) or choose to prepare for occupations for which there is only a weak demand. In saying this I challenge the validity of both the "manpower" and the social (let alone private) monetary rate-of-return indicators of malallocation of resources to and in education.[22] Once again, this brings us back to the question of what national income is all about, along with whether we properly measure it.

In referring to "education for the fun of it" I imply that education is a consumer good. There has been a curious tendency to discard as non-economic (or worse) all expenditures on education that do not enhance productive power; yet no one would argue that production of additional clothing, for example, made no contribution to (was no part of) the national income when people did not need the additional clothing to carry on their production of other things. There has been confusion here between arguments over the extent to which schooling was an investment, on the one hand, and issues with respect to public subsidies of one or another activity on the other. If education were not so heavily subsidized there might be less

confusion about acknowledging that education can be both an investment and a consumer good.

The disregard of choices of occupation according to preferences rather than by the requirements handed down by manpower planners often reflects the frustration among the planners when people act in ways they regard as "irrational". Also, often there are distortions of pay scales, with high pay going to preferred bureaucratic jobs – especially in some of the relatively undeveloped nations. In any case, incomes foregone in favor of job satisfactions are not counted in the statistics of national incomes. But if people are willing to buy the privilege of doing certain kinds of work by accepting lower pay for it (as they would in an efficient labor market) or by accepting a higher incidence of unemployment (probably in a less efficient or an artificially pegged labor market), why should they not be granted this privilege? Would we expect total satisfactions and national welfare to be better served if we grant men full freedom to spend their resources on better clothes and automobiles, but disallow their freedom to pay for the privilege of enjoying their hours at work? 23)

The concept of optimal allocation of resources is more fundamental than is monetary benefit-cost analysis, and for this reason the extent of deviation from optimality (or even its existence and direction) eludes direct measurement. Optimality can be approximated only by provision of the correct signals as incentives for decision makers. Congruence of the educational system with the economy in this sense is then a matter of having the right signalling system, not of making peoples' choices for them.

Market distortions, externalities and decision signals

Following the foregoing argument, we must immediately ask: what determines the "right signals", whether in price or employment terms, or in these taken together? One of the main disputes among economists of quite different political leanings has of course been whether market prices (including wages and interest rates) can serve as an effective signalling system. If one believes <u>both</u> that demands for various sorts of human resources are extremely inelastic and that individuals make their educational decisions in disregard of wage expectations, then wage rates at least would be very poor signals. Such beliefs are of course related to the disinterest or outright opposition of some manpower economists to market economics. But with even moderate responsiveness to wage expectations in the human-investment decisions of individuals, wage signals become important. That many people may choose to enter a job that offers lower pay while other job markets are cleared only at much higher pay for the same levels of educational investment does not change the fact that wages are relevant decision parameters.

It does not follow, however, that the market (public or private) is giving correct wage or cost signals. These signals may be distorted for any of a number of reasons. Examples are: (a) direct wage fixing in protected spheres and related government policies that distort wage relationships as indicators of relative productivity; b) certification biases; c) distortions of life-time signals associated with social security provisions and income taxes; d) pricing of education that is out of line with costs; and (e) "externality" or "spillover" effects, positive or negative.

(a) Direct wage fixing in protected spheres is likely to produce unemployment queues in those spheres unless there is also a direct control on entry into training for these protected jobs or occupations. The signal to individual decision makers (and estimated private monetary rates of return) will be a mixture of wage expectations and expected unemployment (or queuing time). Social rates of return will be systematically lower than private rates, with a corresponding systematic bias in the signalling system. If the wage-fixing is regarded as desirable, then the associated long-term rate of equilibrium unemployment or queuing to which it gives rise must be incorporated in the shadow pricing of labor costs of investment projects that increase the demand for "protected sphere" workers. Arnold Harberger[24] has demonstrated this clearly. Make-work and bureaucratic jobs that are selectively provided according to schooling may reduce or eliminate the queues, but the distortion of wage signalling for human investment decisions remains; in fact it can become even more serious because the disincentive aspect of queuing is removed. Moreover, there is the danger that such a system will feed upon itself, with a growing bureaucratic bloat that ultimately threatens the viability of the entire economy; incentives to seek other jobs that may be less appealing to educated men and women but that are nevertheless more productive are undermined, along with the distortion of incentive signals with respect to investments of time and resources in schooling.

Minimum wage rules that cover new along with experienced workers lead to other distortions as well. They block investments in post-school learning that would otherwise be made by individuals - investments that take the form of accepting lower present earnings for the sake of learning on the job and consequent greater future earning power. Subsidies to firms hiring new workers at the minimum wage can encourage redesign of jobs or make new training activities worthwhile to the firm, but those subsidies will not correct the signalling bias and constraints on individuals in their choices among post-school options for learning and earning. The subsidies would encourage only those sorts of investments in training by a firm that tend to tie the trainee to that firm and to discourage mobility in the labor force. Unfortunately, to the minimum-wage constraints in Sweden has now been added a

new law making it extremely difficult for an employer to get rid of an individual worker once he has been hired. This makes it even more difficult than before for marginal groups in the labor force to get employment. Apparently there is now talk of forcing employers to accept quotas for such groups to counteract this effect. Although such a policy may be reasonably argued in a "third-best" world, the rigidities being imposed on labor markets do not promise well for the continued viability and productivity of the Swedish economy, which has gained so much in the past from the systematic rationalization and upgrading of productivity in the crucial export industries. Rigid parity rules in wage bargaining can also impede adjustments to geographical disparities and, especially, to technological and organizational progress, with substantial concealed effects on human resource development in the working years.

(b) Certification bias has been much discussed recently. The certificate or diploma surely is a measure of competence, but it is a very imperfect measure. Moreover, it can be as much a reflection of characteristics of the individual when he entered into post-compulsory schooling, for example, as of what he added to his competence with that additional schooling. To the extent that years in school mainly "screen" by traits such as ability and motivation, irrespective of any learning that takes place, we may have an expensive and inefficient information system at entry to the job market. The excess social costs of this process could be very high even though employers are entirely rational in using certificates as a probabilistic, and to them costless, way of sorting people out for hiring and post-school trining. To the individual, the important thing is that acquiring the certificate adds earning power and career opportunities, whatever changes the schooling may or may not have made in his capabilities. The greater the extent to which centralized government agencies participate in the direct processes of selection and allocation of youth into one sphere of activity or another, the more likely it will be that certification will constrain choices, reduce flexibility of adaptation in schools and labor markets, and distort the decision signals passed on to individuals and firms. It takes an unusual awareness of these problems to overcome the bias toward obtaining order by certification among those attempting to manage a complex economy through detailed governmental controls.

(c) and (d) Both income taxes and social security provisions raise awkward problems for societal signalling of costs and life-time benefits associated with education. I shall confine my comments here to income taxes, however. Those taxes (whether proportional or progressive) systematically narrow returns in disposable income to the individual from investment in himself as compared with the social returns. The latter may be measured better by treating a man's gross earnings as the indicator of his productivity. One can view

the income tax paid on increased earnings (the increase attributable to schooling) as a repayment in later years for investments made by society in the form of (d) tuition subsidies and stipends during the school years. Thus (c) and (d) on our list must be considered jointly in any attempt to specify the net advantages of educational investments signalled by the system. The combination of public subsidy and indirect subsequent repayment through higher income taxes is closer to a contingent loan system than sometimes is believed. The grants could be viewed as quasi-loans with repayment contingent on realized returns: those whose later incomes were not increased by the schooling will make no such repayments, no matter what was invested in their schooling. The grants plus income-tax effect on the individual's calculus differs from a contingent loan system in that the former carries no specified interest rate and no upper limit is set on the amount of repayment or amortization of the initial investment funds. But like contingent loans, the combination of initial grants and later taxes is plagued by what is termed "moral hazards" in the language of insurance systems: repayment can be avoided in whole or in part by selecting occupations with a larger component of consumption or job satisfaction rather than higher pay. Freedom to choose an occupation that yields lower pay but more enjoyment can be one of the most important freedoms, but this fact does not justify public subsidy without repayment. Thus even the Swedish system of contingent loans as a way of financing subsistence while enrolled in a university will constitute a full subsidy to many of those who anticipate mainly non-monetary returns. If repayment is contingent on income but not on earnings, those who anticipate relatively high incomes from sources other than earnings will of course be the least inclined to make use of the loans in the first place. Obviously, if a contingent loan system is to be self-financing, this will have to be at much higher interest rates than would be required if repayment was not contingent.

The debates over finance in higher education are further confounded by the fact that both grants and loans constitute part of a policy designed to make university education available to youth from poorer homes. But where tuition is free to all, this distributive purpose is perverted. Through the public treasury the relatively disadvantaged members of the society are helping finance those who have more - whether in parental income or in the most important inheritance of all, the human capital with which they are born and which they acquired in favorable home environments. These distributive problems are not the most awkward of the problems of proper signalling of educational benefits and costs, however.

Dilemmas in signalling accurately the costs and benefits of education remain troublesome by virtue of the very fact that education does affect potential earnings and that the increments to earnings inevitably must be taxed. There is no single, indisputably right strategy. The alternative of rationing places

by restricting numbers in universities directly is a much more drastic constraint on freedom of choice than rationing by pricing - charging the cost of the education to those who use it and providing financial access through a system of loans. As the consumer-good and job-satisfaction components of anticipated returns to education rise in importance relative to anticipated monetary benefits, the case for increasing reliance on ordinary (not merely contingent) loans becomes stronger.

(e) Much of what has been said in the immediately preceding paragraphs is related to another problem: the persistent and economically difficult matter of "spillovers", or "externalities". Usually it is supposed that education will have indirect benefits to society at large over and above the consumption and investment returns to the educated individuals. This belief undoubtedly accounts in large measure for a history of subsidies to the lower levels of education and for compulsory education laws. If there are substantial positive social spillovers from higher education, this could justify corresponding subsidies to attract more youth into universities. But it is not at all clear that spillovers for all levels of schooling are in fact positive at the margins, and effects at the decision margins will often be what matters. Sometimes there may even be negative spillover effects, but the question is for which levels and which kinds of schooling, and in what contexts. Too often, in my judgment, men who have asserted negative spillovers (usually in somewhat different terminology) are making the wrong identification of negative effects and are posing the wrong solutions. Thus, I contend that it is a mistake to argue against general and for special agricultural curricula in rural primary schools to prevent migration to towns (which it won't do), or to press for more "vocationalization" in secondary schools (which is in many cases not only expensive but actually incongruent with labor-market demands and rewards). But it is difficult to make a strong a priori argument for expecting positive spillover effects at the margins for increasing college enrolments where larger fractions of youth already are going to college, or when there has been a recent rapid increase in college attendance unaccompanied by substantial investments in physical capital. It must be remembered that so long as graduates receive earnings that match their productivity, there will be no spillover effects associated simply with meeting the demands for skilled manpower in economic development. Spillovers or "externalities" are returns that accrue to society in excess of anything received by the immediate parties to an activity or exchange - in this case by the individual university graduate. This is why some American economists have argued that subsidies to women in the universities are justified by the indirect benefits that will accrue to their children. Whether that sort of justification of contingent loans (or grants) to women can persist in a society that is expanding subsidized child-care facilities and urging women into the labor market might be debated. In any case, I suggest that the most difficult policy questions with respect to externalities associated with higher education in industrially advanced societies

cluster around screening and certification systems (with negative externality effects) and around the complementarities between educational functions of higher institutions and the production of research.

Careers, post-school learning and change

Schools presumably prepare the rising generation not just for a target year but to participate in adult society over a long span of years during which many things will change. This is why I specified earlier that occurrence of shifts between jobs and retraining of adults are not due to incongruence of the educational system with the requirements of growth. Only a few years ago many manpower economists were referring to job mobility during a man's lifetime as evidence of previous planning errors; retraining and upgrading were viewed as remedies for prior poor planning. That is much too static a view of economic life. Obviously some adult training and rehabilitation are indeed corrective programs that are poor substitutes for an adequate basic education that was missed at younger years. But by the same token, the fundamental reason for schooling as an investment in the early years is the preparation of youth to learn efficiently, to adapt, and to make decisions in a changing world. Although the now-conventional human-investment economics does not provide a dynamic theory of economic growth, it does emphasize the importance of post-school learning and earning paths and shows their relationship to prior schooling. This, and not rate--of-return prescriptions, is the heart of the modern theory of investments in human beings.

This is not the place in which to single out the seminal work in the economics of human investment and careers,[25] but a few of the key ideas are especially pertinent. Basic in this work is the distinction between what I term "Becker-general" and "Becker-specific" skills, which are not the same thing as technologically general or specialized skills. Becker-general learning is that learning on which the individual may recoup returns elsewhere than in the agency or firm where the learning took place, while Becker-specific learning makes the individual more productive only so long as he continues to work in the same enterprise. Learning in schools is normally Becker--general; graduates will go out to use their skills in other settings. Learning at work is normally mixed; sometimes it is largely general, sometimes largely specific. This learning and training may be formalized, but it may equally well be informal; there are dead-end jobs and there are jobs with large components of learning by doing. When the post-school learning is predominantly Becker-general, employers have no reason to bear the cost; instead, the individual invests in himself by foregoing higher immediate earnings in favor of substantially higher future earnings. When that learning is Becker-specific, employers will share in and may bear the major part of the costs. All-in-all, it has been estimated

that for the United States the total investment in post-school learning over a lifetime has been of approximately the same magnitude as total investment in schooling, private and public. When we look at schools, we are looking at only half of the resource inputs into American education.

It is my conviction that the most critical educational question from a growth perspective concerns what happens at work rather than at school. Furthermore, this implies that learning at work has crucial effects on the distribution of income and wealth. Schools are important for the post-school phase of career development as they may prepare individuals for more effective post-school learning. They also may sort people into groups who will have access to differing sets of subsequent investment options and hence opportunities to demonstrate the extent (and limitations) of their capabilities in working life. There are important differences among societies in the range of opportunities they provide for post-school development of human resources and in the availability of those opportunities to greater or smaller segments of the population. In less-developed countries, technological dualism typically reflects gaps in human resources that possess the sorts of know-how best acquired through work experience, and this dualism in turn impedes the development of that essential know-how.[26] More generally, in all nations the extent of learning at work is a function of the pace of technological progress, which in turn depends on the adaptability of the labor force. Given a favorable political and policy setting, schools can provide a solid base on which to build adaptability and the capacity of the work force to support and sustain dynamic change. But the schools will be effective in this role only if they are given the freedom to carry it out, and only to the extent that other economic and political institutions, public and private, foster innovative behaviour. No matter what happens in schools, the multiplication of sinecures in over-staffed and unimaginative bureaucracies retards the development of human beings who can be creative and vitalizing agents of economic and social progress. There are many ways to structure economic institutions to support continuing human development, flexible adjustments to change, and innovative behaviour - as both Japanese and Western history clearly attest. The essential point is that congruence of the educational system with sustained growth requires two things: a solid basic education among the population, and economic institutions that encourage diverse opportunities for learning and training at work. The "congruence" has to work two ways.

Lifetime perspectives on opportunity

The main theme of this essay has centered around strategies for allocation of resources in the formation of productive capabilities, whether in school or through post-school learning.

Again and again, when we look at the political processes through which public decisions are made and at the societal criteria that are brought to bear on educational planning in particular, the importance of value attitudes and disputes relating to concepts of justice, eqvity, and egalitarianism come to the fore. In the end these concerns, together with concerns for freedom to express choices and to make use of opportunities, become interwoven with the formulation and activation of both educational and labor-market policies.

Without exploring interconnections among basic values, we can take note of some relationships between the economics of human investments and the distribution of incomes and opportunities. (1) First, the inequalities that most people would regard as important are those that are understood best in life-time perspective. Few worry that young men earn less, or have lower total incomes, than mature men. Furthermore, as needs arise differences in earnings over an individual's life cycle can be (and to a considerable extent are) dealt with comparatively easily by public programs that take money from the individual when he is best able to pay and contribute to serving his needs when he is not so well able to meet them - primarily during schooling and in old age. (2) Second, when an individual makes an investment in education or in learning at work (whether through direct payments or foregone earnings) he voluntarily exchanges purchasing power in the present for higher earning power in the future; if all individuals had the same opportunities and options in making such investments and in securing the returns on them, life-time inequalities in earnings would come solely from voluntary decisions. Property income aside, if full equality of opportunity in making these choices could be ensured, with full information about the consequences, it would seem that the most important economic inequalities could be removed. (3) Still assuming the possibility of equalizing options as specified in (2) policy could be designed to take into account elements of chance that bring about unanticipated depressions in the earnings profiles - as from accident or illness. Such misfortunes could be covered through insurance and no special problem for educational policy arises.

The critical issue for distributive justice or equalization of opportunity then comes back to the phrase in (2), "if all individuals had the same opportunities and options in making such investments and in securing returns on them". Some of the factors that interfere with realization of equality of opportunity in these respects are difficult if not impossible to surmount, or they can be overcome only over a period of more than one generation. Among those most difficult problems are the wide variations in abilities and in attitudes inherited either genetically or from the home environments of early childhood. Less difficult to overcome are the differences among individuals in ability to finance post-compulsory schooling, (which means not only to pay its direct costs but to hold themselves off the

labor market for a long period). How far policy makers will accept equalizing and compensatory programs, especially where these come into conflict with strategies for raising national income or ensuring a rapid pace of economic growth, will differ from one economic situation and society to another. But in any case one fundamental set of policy questions is indicated: to what extent do existing policies and institutions aggravate, to what extent do they alleviate, contrasts among individuals in access to initial desirable options for human investment and to opportunities to use and develop their capabilities during the post-school years? How far do individuals and families differ in their knowledge of the implications of alternative educational choices? Do differences in educational choices reflect realistic assessments of prospects and awareness of existing options? What alternatives in operation of the educational and economic systems are available to narrow inequalities in opportunities or in knowledge about them, and at what costs? And how do answers to this last question look in a longer as against a shorter perspective? It is important to keep in mind that the crucial questions about justice or equity are ultimately questions about life-time opportunities.

Welfare, freedom and control

Early in this paper I referred to the monograph by Roos on welfare theory and social policy in which he emphasized the multidimensional nature of welfare. "It would be very difficult to think of social welfare without justice, equality, freedom, or in fact any of the fundamental ethical principles of practical social policy".[27] He puts freedom at the center of his analysis of welfare, and in a broad interpretation makes it almost coincident with welfare. This emphasis reflects the way he conceives "freedom" and the role of people in determining their own destinies. Freedom to Roos is inseparable from the exercise of control, not its opposite; his analysis is subtle. Thus Roos rejects the advocates of purely "spontaneous" control - the position of the anarchist and of the most extreme stereotype of laissez-faire economics. But he is equally critical of advocates of control as that term is usually understood - that is, of bureaucratic control, from the top down.[28]

> Conscious social control by the people requires a conception of social welfare decidedly different from that which advocates bureaucratic control. And to achieve true welfare, only some forms of control can be acceptable.
>
> In the final analysis, we are left with this nuclear problem: how can the divergent interests of men in any society be reconciled; how can we 'find' social welfare? ... Should we, for instance, decide that bureaucratic control is the ideal means of control, we must ask: how will the bureaucrats solve the

> problem of reconciling all interests in the society? If, on the other hand, we are concerned with some forms of conscious control not involving bureaucratic control (such as self-management), we must ask another set of questions: how are the people supposed to reach decisions which are in their own best interests? In what ways can this happen? ...
>
> One is also confronted with the very general question: shall we attempt to control the social and technological processes affecting men's destinies? Secondary and related to this is the problem: are we concerned with only that in which men are interested, or are we concerned with that which is in men's own interests ...? In the first case the society will be the executor of habitual trivialities ... and in the latter case, the risk is great that policy-makers and social control would become instruments of coercion and manipulation ... My task, it would seem, would be to analyze under what conditions the problems of social welfare would become problems conducive to solution by the people, and not for them by the policy-makers and the scientists.

The task Roos set for himself is a task for all who are concerned with public policy today. To be sure, there are great differences in the ways men seek to resolve the persistent dilemmas of freedom and control. No one would argue that a market system left to itself would ensure that positive freedom, let alone equity, would be fully realized; but only some sort of market system (however it may be structured, and whatever the collective controls) can provide for the exercise of individual freedoms of control and self-management in a myriad of diverse, personally important matters. Some crucial questions in this connection concern the adequacy of information throughout the society - and how far the information collected by public agencies is used to foster informed decision-making by independent individuals and agencies, how far instead it serves central authorities in exercise of control (however benign) over the people.

One of the necessary conditions for collective action that will be responsive to people, and ultimately operable, is an underlying consensus on how things will be done and the rules of the game. But there is another aspect of consensus that may also be highly relevant to policy decisions. This is the consensus or conformity of tastes and ways of life among members of a population that is homogeneous in its history and culture. Where a population is very homogeneous (as it still is in Sweden, despite the new migrants from Mediterranean countries) some detailed central controls may be accepted with little awareness of the constraints they place on how people make a living, or spend their incomes, or use their non-working time. Where there is a great heterogeneity of

cultural heritage and ways of life, public controls in similar detail will be strongly resented and are likely to be quite unenforceable.

The variety and scope for choice in educational alternatives, formal or informal, will be greater where people are free to move through a large, relatively affluent, decentralized and heterogeneous society such as the United States. There, but also in England, there has been spontaneous growth of educational institutions that sometimes have been called "the invisible educational system". The system is called "invisible" because it is so little understood among the academics and bureaucrats who write papers and attend conferences on educational planning, and because much of it has been outside of the experience of relatively advantaged, "middle-class" people. Probably there has been more of this sort of activity in other nations than most of us realize. In a smaller country, with more centralized management and with narrow limitations on activities of non-public institutions, less is likely to happen in response to economic and social changes without conscious planning or deliberate encouragement from the center. And there is always the temptation among people whose job it is to lay out programs and policies to take over from the more "disorderly" elements of the educational sector, often regarded with suspicion.

It is also a fact, however, that <u>any</u> socio-economic system embodies constraints of one sort or another on options available to individuals. There is continuous need for untrammeled thinking in reassessments to identify how existing institutions and societal processes may be constraining options, and for creative thinking about how the emergence of potentially valuable new options may be encouraged.[29] Positive freedom in the fullest sense would indeed be a wondrous thing.

5 In conclusion

What are the critical questions that must be asked if economists are to contribute to the formulation of educational policies that are in accordance with economic priorities?

One set of questions would ask about the effects of educational policies upon the distribution of opportunity and of income. Another set might relate to the sorts of economic processes and interrelationships that are valued in their own right. Or we could go on to ask about educational developments as these may affect the "quality of life" or the shape and style of economic growth. These are important questions, and they interest me very much. But they progress from the highly debated to the highly elusive. It is evident only that "achieving congruence between the educational system and the economy" in the broadest sense is many-faceted, with no clear bounds in either the "educational" or the "economic" dimension. In practice, a more modest (even if still ambitious) search for congruence would take national income or growth as the objective function to be maximized, within bounds set by other societal values. This way of proceeding may sometimes lead to later regrets, but here I can only nod and pass on to topics that have constituted the main body of this paper. Four key sets of questions suggest themselves. While each will be stated in general terms, each has substantial pragmatic import.

(1) Are the incentives that condition human-investment decisions of individuals conducive to action in accord with wider social interests? Do these incentives give unbiased signals of social costs and benefits?

(2) Are people informed about the most important matters that may be relevant to them in making choices about education? A whole new branch of behavioral science is developing to deal with questions about the mechanisms and the costs of the "search for information". But we have a long way to go in determining just how well the information systems are working, how they may be improved, and what investments in them will pay off in greater economic product or consumer satisfaction.

(3) Are incentives to firms and to decision-makers in government agencies consistent with social costs and benefits from the utilization of human resources and the formation of competencies through training and experience at work? As a

corollary of this question, we may ask: do economic institutions provide incentives to maintain capabilities and to counter obsolescence in the work force, or are obsolete workers cast on the scrap heap because they are not "worth" the wages that would have to be paid to maintain them? These are questions that require congruence in two directions - of education with the economy, but also of the economy with education.

(4) Which policies narrow, which maintain or widen the range of future options for individuals and for the educational system? The more "errors" we find in projections for the future, the more urgent it becomes to put flexibility high on the list of criteria for policy. At the same time, flexibility is of the essence of dynamic change. This is not just a matter of freedom of choice for individuals, or of their capacities to adapt and innovate. Equally challenging and much more difficult is establishing flexibility at the core of institutions. Educational systems can acquire a momentum of their own, as has become increasingly obvious in recent years in many parts of the world. But at the same time, educational processes and institutions have been widely challenged in the past few years. Perhaps we are still in a period of unusual readiness for constructive change, but time moves on and some sorts of change could narrow future options instead of broadening them. Now is the moment to reorient educational policies to make them more imaginative, more creative, more flexible in adaptations to future events, and more relevant to people as they live out their lives.

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Footnotes

For helpful comments and suggestions the author is indebted to C Arnold Anderson, Lars Werin, and Bengt-Christer Ysander. None of them should be held responsible, however, for the views expressed here.

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1. J P Roos, Welfare Theory and Social Policy. A Study in Policy Science, Commentationes Scientiarum Socialium 4, 1973 (Helsinki - Helsingfors).

2. ibid p 14

3. ibid pp 14-15

4. ibid p 12

5. ibid p 12

6. T W Schultz, Transforming Traditional Agriculture, New Haven, Conn.: Yale University Press, 1964.

7. O.E.C.D., Occupational and Educational Structures of the Labour Force and Levels of Educational Development, Paris, 1970, p 23.

8. Several types of data have been used separately or jointly in these efforts - notably international comparisons, longitudinal analysis and projection of past trends within a country, and inter-firm comparisons. However, data constraints together with other inhibitions to the second and third of these alternatives have limited their use, and the major findings come from cross-section international comparisons.

9. At first those who started from a manpower orientation expressed puzzlement that the higher within-occupation associations between levels of national income and educational attainment should turn up in the management and especially the sales occupations. The neo-classical economist, with his less technological orientation, is not surprised by this finding: these are in fact precisely the occupational categories within which we find maximal educational diversity and variation in productivity even in any given place and time. Nor should it in fact surprise the manpower requirements forecaster. Rather,

this result suggests that the most serious occupational non-comparabilities (including non-comparabilities in client demands) may be in precisely these occupational categories. This can hardly give much solace to the conventional practicing manpower analyst, however.

10. Samuel Bowles, "Aggregation of Labor Inputs in the Economics of Growth and Planning: Experiments with a Two-Level CES Function", Journal of Political Economy, Vol. 78, No. 1, pp 68-81.

11. Op cit pp 248-9.

12. The most sophisticated empirical analyses I have seen are by Finis Welch, using data across the states of the United States. See his "Linear Synthesis of Skill Distributions", Journal of Human Resources, Vol. IV, No. 3, 1969, pp 311-27, and his "Education in Production", Journal of Political Economy, Vol. 78, No. 1, 1970.

13. O.E.C.D., op cit p 178.

14. ibid p 248

15. ibid p 178-9. See also the model suggested by Malinvaud and summarized in my essay on "The Economics of Education" in Methodology of Educational Research, a special issue of the Review of Educational Research, Vol. 39, No. 5, December 1969, pp 641-70.

16. C Arnold Anderson and Mary Jean Bowman, "Concerning the Role of Education in Development", in Clifford Geertz (Ed.), Old Societies and New States, Glencoe (Free Press), pp 247-79.

17. See footnote 15, above.

18. For the United States see especially Richard Freeman, Markets for College Trained Manpower, Cambridge, Mass.: Harvard University Press, 1971. Of considerable interest also are Freeman's most recent papers concerning the reversals in the market situation for college graduates and newly qualified professional men and women. See Richard B Freeman and David W Breneman, Forecasting the Ph.D. Labor Market: Pitfalls for Policy, National Board of Graduate Education, Technical Report 2, Washington, D.C., April 1974. Using a behavioral model based on econometric analysis of past responses, Freeman arrives at predictions of future enrolments in selected graduate faculties that are roughly half or less of the estimates made by people in the government and elsewhere who were using less analytical models that disregard economic decision theory. Freeman's prediction record is much better thus far.

19. It may be that the O.E.C.D. manpower people capitulated a bit more quickly than their evidence required. For even within their models there can be considerable room for manoeuvre. Manpower assessments typically begin at fact by admitting a considerable range of choice. For one thing, many subdivisions of skills that the neo-classical economist would distinguish in his theoretical formulations, with varying potential substitutability, will be ignored in the input-output matrices constructed for manpower planning. The effect is to assume perfect substitutability among those skills that are classified together and zero substitution between the skills that are put in separate categories. Since in the manpower models there is no pricing of benefits and costs, within defined skill categories there can be no "problems" of investments in education or training in the allocation of manpower. The dead end of determinism is avoided by users of fixed-coefficient models in other ways also, including refined ways of defining "technologies" and hence changes in them and allowance for wide variations in the mixture of final products to be turned out by the economy.

20. On this see the excellent discussion, applicable to other countries as well, in Chapters 1 and 10 of Mark Blaug, Richard Layard and Maureen Woodhall, The Causes of Graduate Unemployment in India, London, Allen Lane the Penguin Press, 1969.

21. Where there are persistently high private rates of return there will of course be questions about direct restrictions on entry to the relevant schooling or occupation and about capital markets for funds to invest in one's self.

22. For a fuller discussion of excess and shortage see Mary Jean Bowman, "Educational Shortage and Excess", Canadian Journal of Economics and Political Science, Vol. 29, No. 4, 1963, pp 446-61.

23. Oscar Lange put this very clearly long ago in his famous essay "On the Economic Theory of Socialism", Review of Economic Studies, Vol. IV, Nos. 1 and 2, October 1936 and February 1937. This essay is available (with an essay by Fred M Taylor and an introduction by Banjamin E Lippincott) in a paperback with the same title, published by McGraw-Hill, 1964.

24. Arnold C Harberger, "On Measuring the Social Opportunity Cost of Labor", International Labour Review, 1971.

25. The pathbreaking articles were Gary S Becker, "Investment in Human Capital: A Theoretical Analysis", and Jacob Mincer, "On-the-job Training: Costs, Returns

and Some Implications", in Journal of Political Economy, Supplement, October 1962. Many other publications have followed, by these and other economists. An analytical assessment of this work through 1973 is given in my "Learning and Earning in the Post-School Years", in Fred N Kerlinger and John B Carroll, eds. Review of Research in Education, 2, Itaca, Illinois, F E Peacock Publisher, 1974, pp 202-44.

26. On this see Mary Jean Bowman, "From Guilds to Infant Training Industries", in C A Anderson and M J Bowman (eds.) Education and Economic Development, Chicago, Aldine Press, 1965.

27. Op cit p 49.

28. ibid pp 211-12, p 217

29. Gösta Rehn's well-known work is an example of just such independent and creative thinking. One of his recent papers, which I have seen only in mimeographed form, bears the appropriate title "Towards a Society of Free Choice".

II

Åsa Sohlman

EDUCATION AND THE LABOUR MARKET. THE SWEDISH EXPERIENCE 1900–1975

This paper is a byproduct from a research project, sponsored by the Office of the Chancellor of the Swedish Universities and entitled "Education and the Labour Market". For fuller empirical documentation see Åsa Sohlman: Utbildning och arbetsmarknad. Working paper No 1976:1, Department of Economics, University of Stockholm.

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Introduction

In many fundamental respects the present Swedish educational system differs from that of 1900. Especially the last 30 years have been a period of great changes and important reforms. Even if Sweden can not be said to have entered the era of mass higher education it has successively progressed from mass primary to mass secondary education.

However, this development has not always been a smooth one. Different opinions have been confronted as to the appropriate tasks for the formal educational system, its organisation and the potential effects of educational policy. New objectives have been added to old ones. New problems have arisen as old ones have disappeared or sometimes because of the way in which the old ones were solved.

In this paper empirical data will be presented with the purpose of achieving a summary description of the development of the Swedish educational system from a labour market point of view. Our interest is with the educational system as a whole interacting with the labour market, the development of the educational system and interrelated changes at different educational levels. This approach can give a wider perspective on some of the problems the educational system is and will be confronting.

The descriptive material will be used in an attempt to answer and discuss two types of questions:

1. To what extent have the objectives of the official educational policy with respect to the labour market been reached? What has the development looked like within the different fields of interest?
2. How can these data be interpreted theoretically? What are the relations between educational and economic variables and how are they to be understood? What are the effects of educational policy? To what extent can the conception of relations between education and the labour market on which the official policy is based be said to be born out by data? What theoretical models do seem appropriate in the case of Sweden considering the problems at hand? Those familiar with the theoretical literature on education will recognise that these questions bring us close to the on-going debate on education as a human capital investment versus education as a sorting devise. We will not be able to settle this dispute but we do suggest how work in this field could be persued in accordance with the Swedish experience.

For the empirical survey we have not undertaken any original research work to obtain new statistical data. The survey is based on currently produced statistics and special investigations made by other research workers. We have tried to bring together what we have judged to be the best relevant information. However, being restricted to this data base the picture of the parallel development of the educational system and the labour market will be painted with rather conventional brushes. We will have more to say about the development in quantitative terms than in qualitative terms, more on an aggregated level than on a disaggregated level. Broad definitions are used. Education is measured by years or by a number of educational levels. The content of any such box can be most varying. - Even though it would be desirable to make more detailed descriptions in the future the present survey can serve the purpose of giving a first rough illustration of the development and thus point out areas for further research.

The education-labour market data have been organised in two sets. The first one contains data mainly relevant for discussing allocation and economic growth and the second those mainly relevant from a distributional point of view. Of course, certain types of data can illustrate effects of both types and will be used for both purposes in the summary discussions of the last section. Within these two areas we will use as a point of departure for our description the types of effects aimed at by official educational policy. Although some cost figures will be mentioned this study is not aimed at systematically analysing the costs involved.

As for the definition of "educational system" and "educational policy" we proceeded in a rather pragmatic way. The educational system was identified with those types of education that have been more or less continuously covered by statistics, that is the formal public educational system. We can not say exactly what share of the total educational activities in society they cover. The public educational system in Sweden has during its development taken over more and more educational tasks from the families, private educational institutions and business firms. The share of the Swedish population engaged on a full time basis either as teachers or students in the public educational system in 1970 was estimated at 20%.[1)] It is thus possible that the share of educational activities we are describing has increased over time. Educational activities outside the formal educational system may, however, also have expanded. In some instances an attempt will be made at indicating at least the order of magnitude of certain types of education outside the formal public educational system. In describing educational policy we will only consider policy measures which had the primary aim of directly influencing educational activities.

Of course, labour market considerations have not been the sole determinant of educational policy. However, it seems

fair to say that they have, at all times, influenced the formulation of the Swedish educational policy. The weight attached to them has varied over time as well as the extent to which they have been controversial. At present they seem to be as important and perhaps as controversial as ever.

The plan of this paper is the following:

In the first section the official educational policy will be briefly described as far as it has been concerned with education and the labour market. The objectives, means and general perception of the relations between education and the economy will be indicated. We will also briefly summarise the organisational development of the public educational system. This will facilitate the reading of the statistical material that will be presented later as well as further elucidate the educational objectives as expressed by organisational reforms.

The quantitative development of the educational system is surveyed in section 2. Against this background the effects of education on allocation and growth are investigated in section 3. The description will be based both on disaggregated labour market data and data at the macro level.

Section 4 illustrates the functioning of the educational system as a distributional devise. First the distribution of educational resources is considered. Thereafter the distributional effects of education due to its effects upon such things as earnings are studied.

To get a further perspective on the Swedish development some international comparisons are made in sections 2 through 4.

Finally, section 5 contains a summary discussion of the results of this empirical investigation.

1 Educational objectives with respect to the labour market and organizational reforms[2)]

Generally speaking, educational policy can influence educational activities in society via the supply side and via the demand side. Both supply and demand are, however, determined by a host of factors many of which are outside the direct reach of educational policy. Sometimes individual demand is, however, overruled as when certain types of education are made compulsory. To a considerable extent the Swedish educational expansion originates directly or indirectly in the prolongation of compulsory schooling.

As to the optional levels of the public educational system it can be noted that in Sweden, as in many other countries, the price mechanism, equilibrating demand and supply, has been suspended. In such a situation either the demand or the supply will determine the quantitative development of education. Normally, the number of class-room seats has been a factor which directly restricts the volume of education. Of course, this does not mean that the development of demand did not have a bearing upon the supply of places.

The secondary schools used to attract more applicants than places available. This is still so for upper secondary education, though certain changes have been noted lately. The number of applicants has at least in some instances and for some branches become smaller than the number of places available. As for higher education a numerus clauses has traditionally been applied to an important number of study--courses. These restrictions did, with a few exceptions lately, always hold enrolment back. The main exceptions to this policy have been the "free" faculties, the faculties of theology, law, liberal arts, social sciences and to a certain extent natural sciences, where all qualified applicants were admitted. Because of the qualification requirements, the scope for individual demand at this educational level was, however, rather limited.[3)]

Considering the size of the public educational system and this rather tangible control of its quantitative development it may appear all the more interesting to investigate the motives behind the educational policy.

Of course, the educational policy is not formulated in a vacuum. The political decisions are the outcome of a complicated process. We do not intend to describe this often dramatic process. We concentrate upon the final decisions. In Sweden

they were often the result of political compromise. It is therefore no wonder that official documents sometimes lack precision. The basis for the educational policy, the assumed relations between education and the economy and between educational policy measures and goals are not always clearly stated.

1.1 Policy objectives

The main policy objectives pertaining to education and the labour market will be briefly described under the three headings social change, distribution, and allocation and growth.

Social change

One aim of the more important educational reforms has been to achieve a gradual change in society. Educational policy has been considered as a potential force to transform the social framework within which both the allocative and distributional mechanisms have to work as well as these mechanisms themselves. Thereby of course the conditions regulating the labour market would also change.

The development of society has been regarded as demanding a restructuring of the educational system. At the same time changes in the educational system have been considered a prerequisite for further social change. A democratic society needs a democratic educational system and a democratic educational system can permit a deepening of democracy in society as well as on the labour market.

These considerations have motivated the introduction of a public school system that is compulsory and tuition free, a prolongation of compulsory schooling from 6 to 9 years and changes in curricula and teaching methods.[4)]

Already in the 19th century it was suggested that compulsory education was not enough to achieve these objectives of developing a democratic system. It was argued that a basic education common to all was necessary in order to develop a democratic spirit and to strengthen democratic values such as solidarity, tolerance and co-operativeness. All citizens ought to have a common core of learning, a common reference-basis for their participation in political, social, economic and cultural life. During the 20th century these ideas were realised as will be described below with the transfer of all basic education into public comprehensive schools, the organisational unification of these schools and the standardisation of their programmes.

As even those who had the lowest education on the labour market became equipped with a solid basic education and a sufficient amount of self-esteem they could be expected to demand better pay and a restructuring of jobs and employers

to accept such changes. It might seem all the more plausible to look forward to these indirect effects of education upon the labour market, that work themselves out via attitudinal change, as a basic amount of education became common to all.

At a later stage the opening up of certain new types of educational activities within the public educational system such as adult education, recurrent education and vocational technical programmes at the university level have been achieved and partly motivated by the same kind of concerns.

As a recent example of an optimistic view of the possibilities to change the labour market through educational policy let us cite a 1975 government Bill:

Higher education "must support the efforts in society to create equality. It should among other things be able to change the division of labour and the recruitment patterns in a more democratic direction".

Distribution

Besides having these long run effects upon society, educational policy has been considered capable of more directly influencing variables that are important from a distributional point of view, that is educational resources and working conditions (earnings, unemployment etc). The aim of educational policy with respect to the distribution of these variables seems to have been:

- given an unequal distribution of educational resources, earnings etc to secure for every-one (without regard to social origin, sex, place of residence, age etc) an equal chance of attaining high educational and income levels.[5]
- to equalise the distribution of educational resources (e.g. within and between generations) and reduce the differences in earnings and other conditions of work.[6]

The fact that all groups did not utilise the educational system to the same extent was assumed to be due to barriers of different sorts. And, the removal of the barriers would reduce the differences. Policy measures in this area have been aimed at removing first financial and formal barriers and later what could be called emotional barriers. That is, the policies have been directed towards:[7]

- increasing the financial aid to students
- widening the geographical spread of educational facilities
- reforming basic education making it comprehensive and less differentiated
- changing the qualification requirements

- changing curricula
- introducing new types of education
- applying a more active recruitment policy.

Education has apparently also been seen as influencing the individual's possibilities on the labour market. This belief seems to be based mainly on a human capital approach. Education develops the capacities of the individual. The educational system does not solely sort out individuals according to "innate" ability or any other feature not influenced by education.

The fact that people with higher education are better paid could within this frame-work be explained by a demand for the capacities developed by higher education that is high relative to supply. Given the assumptions:

- the ability to pursue studies at higher educational levels does not vary between relevant groups
- higher education develops the individual's capacities
- these capacities are demanded by the labour market

a change in e.g. the social composition of the student body, equalising educational opportunity, would also lead to a social equalisation of the chances of obtaining high incomes provided the demand and supply relations remain the same.

The policy measures to achieve this income equalisation would thus be first to remove the barriers to education as discussed above and second to prevent the demand-supply conditions from changing. It is possible that the initiatives toward a greater control of student numbers, for example in the reform of higher education decided upon in 1975 (see below) should be understood from this perspective.

However, an equalisation of chances has not been the sole objective. It has been declared that the distribution of income and welfare should become more even. Whether educational policy would be capable of achieving this directly or only via more general changes in society has not been explicitely indicated. It has been suggested, however, that an increase in the level of education in the population as well as a more equal distribution of individuals over educational levels would promote these aims but not why this should be so. With a perception of education as described above it would of course be possible to achieve income equalisation directly by means of educational policy. What kind of educational policy this requires depends for one thing on what the demand conditions on the labour market look like and how they are developing. With demand conditions producing constant differences in earnings as between educational groups complete income equalisation could only be obtained if everyone had the same education. If income differences decrease when the supply of persons with higher education is

increased, income equalisation does not presuppose the same amount of education for everyone. It is difficult to say what stand educational policy makers have taken on these matters.[8]

Allocation and growth

The allocation of resources to and within the educational sector to secure, from a labour market point of view, an efficient utilisation of resources and economic growth has been discussed at two different levels that we may call the micro and macro levels. We shall indicate how the objectives have been formulated at these two different levels. Let us just first point out that even with a labour market perspective growth does not have to be interpreted in a narrow way to mean only growth in the production of goods and services. It can also include the growth of good working conditions, occupational pride, satisfaction etc.

At the micro level the educational system can be regarded as a link between "raw" labour and the labour market. The individuals must be provided with knowledge and skills demanded on the labour market and get informed about what is demanded on the labour market. These individuals must also be knowledgable about their interests and the jobs they are suited for. The educational system participates in all these processes. It is also supposed to give information in the opposite direction, that is, from the educational system to the labour market so that the labour force can be effectively used.

The discussion at a micro or more disaggregate level is of old standing. It has, however, mostly turned around the problem of how to adapt the output of the educational system to the development of the labour market (technical changes, capital accumulation, structural changes etc).[9] The weight attached to manpower requirements has varied as for levels and over time. In the government Bill 1975:9 it is said that education at the secondary level is more vocationally oriented than at the primary level and that higher education is to an even still higher degree preparing for working life.[10] The introduction and prolongation of compulsory education was also mainly motivated by its importance for democracy even though it was at the same time considered healthy for economic development.

What labour market needs the public education system should carter for has also been debated. In the 19th century a not unusual opinion was that the public system should not provide vocational or even technical or natural sciences education. However, these types of education, first technical and natural sciences education and later vocational, have gradually been included in the public educational system.

In the 20th century when education at the secondary level expanded the rate of expansion was not so much directly

motivated by labour market considerations. The number of places was increased as fast as possible, given the financial and other restrictions that existed, to correspond to the rising demand for such places. Thus at the end of the 1960s the upper secondary schools had a capacity to receive 90 % of an age-group leaving the compulsory lower secondary schools. The labour market considerations were mainly present in the attempts to direct the flow of students as between more or less theoretical branches and within branches as between different fields of study.[11] Generally more vocationally and less theoretically oriented programmes were favoured.

At the level of higher education the development of the branches with restricted entry has for a long time been discussed in terms of the "need" for persons with these qualifications. As for the "free" faculties the discussion in the 1930s as well as in the 60s centered around the problem of how to maintain an appropriate level and composition of educational output without resorting to a direct regulation of student numbers. Especially it was thought necessary to increase the supply of persons with a natural sciences, technical, social and economic education at the expense of those with a liberal arts education. Vocational guidence activities, both at the secondary schools and at the universities, have gradually been increased. More strictly designed educational programmes were also introduced at the "free" faculties to facilitate the transition from education to work. However, in 1975 Parliament decided to secure a rational development of the number of places with a more fixed planning framework beeing applied to the whole system of higher education. For planning purposes higher education was further devided into five vocational education sectors.[12]

Apparently the substitution possibilities on the labour market and the capacity within the educational system to adapt in a correct way have been regarded as too low at least within the existing institutional framework. Therefore some central planning of the educational output, adapting it to perceived manpower requirements, is needed.

However, the problems involved in planning the educational output in accordance with the "demand" on the labour market have been noticed. Moreover, even if the total number of people with different types of education should in some sense be correct it can make a difference who gets the education. The educational system should therefore permit the individuals to discover their comparative advantages and adapt as they get more information. Adaptability is, however, not only desirable for individuals during their education. Educational content should also be such that once out on the labour market the individual can adapt to new situations and be able to go back to the educational system when more education is needed.

Therefore, while sticking to the planning approach, there has been a tendency towards easing the rigidity of the educational

system. On the one hand an increased mobility within the educational system and between education and work has been aimed at. On the other hand it has been stressed, especially recently, that the educational system must become more flexible in the sense that the types of education offered adapt to the changing conditions on the labour market. To achieve these goals increased information from the labour market to the educational system and from the educational system to the individuals is needed.

Let us give a few examples of measures facilitating mobility within the educational system, on the labour market and between education and work:

- later differentiation in basic education
- increased possibilities to transfer from one educational level to another and to change branch at a given educational level
- expanded adult education and recurrent education (a richer and more varied supply of single courses and short cycle programmes at the level of higher education)
- changed qualification requirements and selection processes in higher education
- curricula changes to achieve broad instead of too specialised education, problem-oriented education, interdisciplinary education
- increased educational and vocational guidence at all levels

and of measures aimed at creating an adaptable educational system:

- increased scope for local initiatives to renew education
- introduction of representatives of public interest and working life on educational boards at different levels.[13)]

That there could exist a need for adaption and increased adaptability on the opposite side, that is in the labour market has not been discussed. Lately it has, however, been recognised that perhaps the educational system should better inform employers about the content of different types of education to permit a more efficient utilisation of labour. It has been proposed that new kinds of educational certificates be introduced for higher education and this would serve that purpose. As well, it has been proposed that higher education be divided into five vocational education sectors and that there be increased contacts with representatives of working life, as for example on the educational boards.[14)]

The discussion at the macro level is of more recent date. The idea to regard education at a macro level as a growth factor in

itself and not merely as a complement to the general economic development only reached Sweden in the 60s via the OECD.[15] Thus even if there are no signs on the labour market that more education is needed increased education can nonetheless lead to a higher economic growth. This way of looking at education increases the scope of action for educational policy but of course it does not quite square with the micro approach in which the substitution possibilities on the labour market were considered to be small. At different times one or the other of these two aspects has been stressed. Perhaps the arguments for education as an independent factor of growth have lost some of their actuality. The 1975 Bill of higher education emphasises the complementarity between education and the development in society and on the labour market.

In policy documents the discussion at the macro level neither became very precise nor were any concrete policy measures ever directly motivated by these types of arguments. They only made policy makers favourably disposed towards educational expansion in general. What was expected in terms of growth was not indicated. Sometimes it has been said that both a generally increased level of education and a more equal distribution of education would promote economic growth but not precisely why this should be the case.

That there could exist a relation in the opposite direction, from economic growth and increased incomes to education, has not often been discussed. This can be due to the generally very negative view of education for consumption purposes.[16]

In the 1950s another type of discussion was going on that could also be related to growth considerations at a macro level. I am referring to the discussion about the "pool of talent" and the educational system's incapacity to bring forth and develop these latent resources. This waste of talent ought to be abolished. A less selective and more flexible school system was expected to achieve this.[17]

Even though it was earlier said that growth does not have to be defined narrowly it is a fact that when policy makers discuss education and growth or education and the labour market from an allocational point of view this is generally done in a narrow perspective. (Discussing education and distribution the perspective has normally been wider bearing upon both earnings and other elements of welfare.) The measures described above could, however, be interpreted as intended to increase not only growth narrowly defined but also the growth of welfare. Increased flexibility and greater possibilities of choice can be important from a welfare point of view.

The educational goals, as described above, generally express an optimistic view of the possibilities to directly and indirectly achieve desired effects by educational means. However, it has been admitted that reaching the goals can be more difficult

than initially thought. More differentiated types of policy actions have therefore been undertaken. A more pronounced need to coordinate educational policy with other types of policy, e.g. labour market policy, has also been felt.[18] This is moreover due to the fact that with the expansion of the educational sector educational policy must both as to objectives and means be integrated into general policy making.

The objectives concerning long run structural changes in society have been present along with the reform activities from the introduction of compulsory primary education to the recent (1975) reform of higher education.

The distributional goals aiming at creating equal opportunity are also old. The ambitions in this area have, however, increased. Not only equal opportunity is aimed at but also an equalisation of the opportunity structure. During the 60s when educational expansion was at its height these goals stood a little less in the forefront. The growth effects of education were highlighted and the educational expansion was perhaps expected to solve the distributional problems.[19] However, in the 1975 Bill they once more occupy a central position. Recently a new dimension has also been added to the distributional objectives as a greater attention has been given to educational differences between generations.

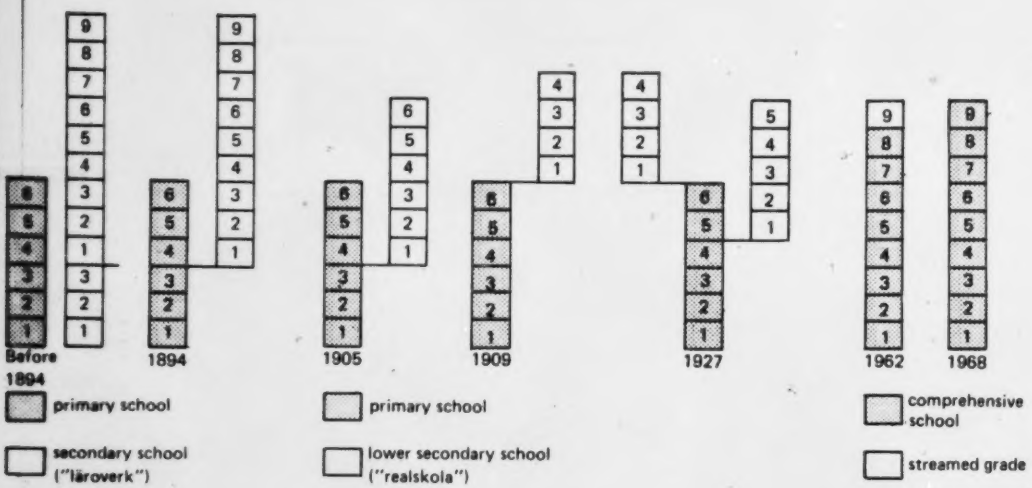
The allocative and growth objects, especially in their micro version, are also of old standing. In this area a broadening of goals has also come about. Practically all sorts of education (except perhaps for consumption purposes) are now considered the responsibility of the public educational system.

1.2 Organizational reforms

As a point of departure let us briefly indicate what the public school system looked like in 1900. It can be devided into three parts:

1. Primary schools ("folkskola"). Compulsory education was introduced in 1842. All children of "school age" had to go to the "folkskola" (with the exception of those who went to public secondary schools, approved private schools or were given the permission to be educated at home). The "school age" normally began the year the child was 7 years old. The first educational plan for these schools was not issued until 1878. It [illegible]ed as the main alternative 6 years of schooling. Local [illegible]ons were, however, considerable and many children received [illegible]ducation much shorter than 6 years. The teachers often lacked teacher training and the equipment was in many cases miserable. The more well-to-do parents therefore normally gave their children private education at least until they could begin secondary school. In 1894 it was established that the entrance qualifications for secondary schools should be knowledge corresponding to 3 grades of primary school. Prior to

Figure 1. Development of the lower educational system



that there existed no link between the "folkskola" and secondary schools as the latter had their own primary schools as indicated in figure 1.

2. Secondary schools ("läroverk"). They prepared for university studies and consisted of 9 grades. What might be called three streams had developed: classical, semi-classical and natural sciences. Since 1862 the secondary schools themselves instead of the universities arranged the examination that qualified for university studies. However, not until 1891 were those who studied natural sciences entitled to go to the universities.

3. Higher education. The two general universities, Uppsala and Lund, together with the Karolinska Medical Institute had a common board of directors. The faculties were four: the faculty of theology, law, medicine, and philosophy (with the liberal arts and natural sciences sections). In addition to this, university education was provided in Stockholm and Gothenburg though not at general state universities. Specialised university colleges provided professional education for veterinaries, dentists, and technicians.

All vocational education at lower levels was privately arranged. The same was, to a large extent, true for the education of girls beyond primary schooling. In 1860, however, a public school for girls the "State Normal Girls' School" had been founded and the public supervision of and financial interest in the private girls' schools gradually grew.

In 1905 the secondary schools were divided into a lower secondary school ("realskola") and a upper secondary school ("gymnasium"). As much of the debate has centered around the

connection between the primary and lower secondary schools and they were finally integrated let us first describe this development.

From a parallel to a comprehensive lower educational system

The new "realskola" that was established in 1905 had 6 grades and lead to the "realexamination" (3 + 6 years). It should give a general education but without latin. The transfer to the "gymnasium" took place after grade five of the "realskola".

In communities lacking secondary schools a new type of lower secondary schools was introduced in 1909. It had 4 grades and was based on 6 years of attendence at primary school. With this combination (6 + 4 grades) the way to the "realexamination" was thus one year longer. This reform was, however, important as in this way another small step away from the parallel school system had been taken at least in some communities (see figure 1).

In 1927 the lower secondary schools of 1905 were reformed. Two connections with the primary schools were introduced, one after 4 and one after 6 years of primary schooling. The respective lower secondary education leading to the "realexamination" was 5 and 4 years long as illustrated by figure 1. In 1927 all the secondary schools were moreover opened to girls.

In many communities, but mainly the urban districts, the primary schools were extended by one optional or compulsory year. Not until 1936 was it, however, decided by Parliament that a seventh compulsory year of education should be added throughout the country. This reform was introduced over a twelve year period.

In 1950 Parliament decided that compulsory education should be extended to 9 years and that a number of 9-year comprehensive schools should be established on an experimental basis. The latter part of the decision gave rise to different interpretations as to whether the experiments with comprehensive schools should lead to the introduction of such schools or their introduction would be conditional upon the results of the experiments. In 1962, however, Parliament decided that a comprehensive, compulsory 9-year school should be introduced. By 1972/73 it was established in all communities. The comprehensive school consists of three departments with three grades each: lower, middle and upper department. In the final grade there were nine streams. In 1968 the streaming in grade 9 was abolished.

From grade 7 and on, however, there is a certain differentiation as pupils in addition to a common nucleus of subjects choose other subjects from special elective groups. These

choices do to a certain extent influence the possibilities of further studies.

Upper secondary schools

The "gymnasium" introduced in 1905 had 4 grades and 2 streams: the classical and the sciences stream. In 1953 a third stream was added: the modern and general stream. The three streams offered at least two branches of study. Besides these, general academic "gymnasia", technical and commercial gymnasia had been founded.

The 1964 reform of the "gymnasia" meant an integration of these different types of gymnasia. The new "gymnasium" had three grades (with the exception of the 4-year technical branch) and was based on the completion of the comprehensive school. As from grade 2 there were 5 different streams: liberal arts, social sciences, economics, natural sciences and technical. In 1964 a new type of upper secondary school was also introduced: the 2-year specialised professional schools ("fackskola"). They were also based on the completion of the comprehensive school and had three different courses of study: social sciences, economics and technical.

In 1968 Parliament decided that a new integrated upper secondary school ("gymnasieskola") should be introduced as from July 1971. The new upper secondary school was to incorporate not only the new "gymnasium" and the specialised professional schools of 1964 but also the vocational schools. Vocational education had existed in various forms over a long period of time. The vocational school system had also expanded considerably. Generally the programmes had, however, been worked out locally. The character, length and starting point of these courses therefore varied substantially. These schools were mainly sponsored by the communities and the State though schools financed by County Councils and industry also existed. The new unified vocational school that was decided upon in 1968 had two grades, was based on 9 years of comprehensive school and gave not only vocational training but also general education.

The new upper secondary school which is still in use has 22 streams. 5 corresponds to the 3- and 4-year courses of the new "gymnasium" of 1964 and 3 to the 2-year courses of the "fackskola".

It can be added that as from 1968 the adult education corresponding to the level of the upper department of the comprehensive school and the upper secondary school (both vocational and general courses) was more firmly organised as the "municipal adult education" was introduced.[20]

Higher education

Over time new general universities and specialised university colleges have been founded as well as new types of institutions of higher education. Among the latter can be mentioned institutes of journalism, of social work, of economics, of sports and gymnastics etc. Beginning in the autumn of 1975 an additional type of specialised university college with vocational technical programmes was introduced on an experimental level. It is intended to serve the need of further study for those active in trade and industry and the education will be based on their vocational experiences.

In 1975 there were 6 general universities (Gothenburg, Lund, Linköping, Stockholm, Uppsala and Umeå) and 3 branch universities affiliate to the general universities.

The division of academic education into faculties has changed. In 1956 the faculty of philosophy was divided into the faculties of liberal arts and of natural sciences. Out of the former later grew the faculty of social sciences. In the 1970s academic education is thus divided into nine faculties (the faculties of theology, law, medicine, natural sciences, liberal arts, social sciences, technology, pharmacy, and dentistry).

In 1975 Parliament decided that all post secondary education should be integrated into a uniform system of higher education, the "högskola".

If we now look behind the organisational framework at the rules governing higher education they had remained unchanged for a long time. The educational expansion, especially at the "free" faculties, however, caused certain problems. As for educational resources the situation was somewhat alleviated by the decision in 1958 to adjust government appropriations for teachers' salaries automatically to the number of students. Moreover, in 1965 Parliament decided that fixed curricula should be introduced also at the "free" faculties, that the number of places in restricted higher education should be expanded and vocational guidance opened up at the universities.

Certain changes were also introduced as to the qualifications required to ask admission to institutions of higher education. Above all it had to be settled what rights the completion of secondary education in the new upper secondary school should bestow on the pupils. In 1972 Parliament decided that completion of studies in at least a two-year line of upper secondary school together with knowledge of Swedish and English corresponding to at least two grades of the social line would give general qualification for higher education. Special qualifications above the general qualifications are, however, stipulated for various courses and educational programmes.

The possibilities for those who have not finished secondary

school to go to institutions of higher education have increased. In 1969 people who were over 25 years and had been gainfully employed for at least 5 years were on an experimental level given the right to follow certain courses at the universities. The reform of higher education decided upon in 1975 implies that those who are over 25 years and have been gainfully employed for 4 years will have general qualifications for higher studies. Command of the Swedish and English language will normally also be required.

The selection to restricted education has normally been based on secondary school merits. The 1975 reform of higher education provides for a more fixed planning framework of the development of student numbers at the "högskola" as well as the number of students following different educational programmes and single courses. A new selection process will be introduced. All applications for admission will be received at a central office. The applications are divided into 4 groups: 1. applicants with three years' upper secondary schooling, 2. applicants with two years' upper secondary schooling, 3. other applicants except those with qualifications from abroad and 4. applicants with qualifications from abroad. Group 1-3 are allotted places in proportion to their share of the total number of applicants. Group 4 is allotted a number of places not surpassing 10%. The selection in groups 1 and 2 is to be based on school merits and working life experience. Admission to a certain proportion of the places available to group 1 and 2 should be determined on the strength of school merits only. Selection in group 3 is to be based on working life experience and the results of a voluntary test of aptitude for studies.

To summarise the development of the public educational system it can be said that it has been characterised by two interdependent tendencies namely towards integration and diversification. At one level after the other the public educational system has assumed the responsability for new types of education. In many cases the need for new types of training was first met by private institutions, then by special public institutions and finally these were integrated into the regular public school system.

The objective as to a common basic education was finally reached with the establishment of the comprehensive school. The parallel public school system has been abolished and local variations have disappeared. The new upper secondary school integrates the old gymnasium, the commercial and technical gymnasia, the specialised professional schools and the vocational schools. The status of vocational education has thereby been increased. The risk of ending up in educational blind alleys at an early age have diminished.

As for higher education the reform decided upon in 1975 implies

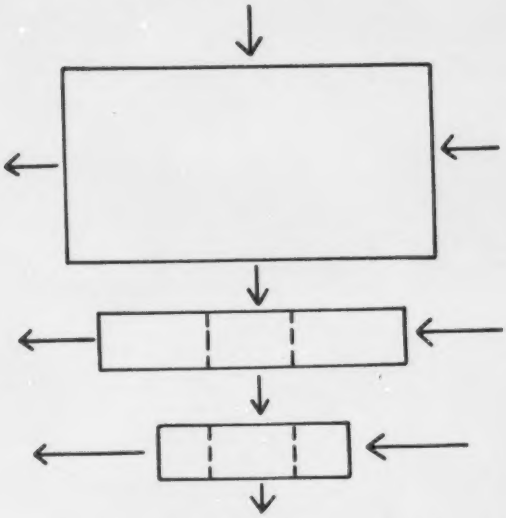
that all public education even at this level will be organisationally integrated.

The tendency towards organisational integration has been coupled with a tendency towards greater differentiation. On the one hand the supply of different types of educations within the public school system has increased (with the exception of education at primary and lower secondary levels). To the classical education (with hebrew, greek and latin) has been added technical, natural sciences and social sciences education. Practical vocational education has also been increased quantitatively and integrated organisationally both at secondary and higher educational levels. On the other hand there has also been a differentiation as to the groups that can utilise the educational system. As for higher education it is now possible to talk about a double connection: one to upper secondary schools and one to working life.

An organisationally uniform educational system with differentiated educational possibilities has been considered appropriate to reach the distributional objectives at the same time as it permits a growth-promoting interaction with a more differentiated and rapidly changing labour market. "Education has been considered an important instrument to strengthen democracy and to equalise the distribution of welfare, influence and possibilities of cultural experiences. A common basic frame of references among citizens promotes understanding and cooperation. This has been and is an important argument in favour of striving for a unified organisation within the educational system ..."21)

2 Educational expansion

This section describes the quantitative development of the Swedish educational system. The quantitative development of an educational system can of course be described in many ways. To give a first general overview we will in part 1 start by presenting some figures on public educational expenditures. As for student numbers, whether measured in absolute or relative terms, there are as indicated by the figure below:


– the flows entering the educational system at various levels
– the stocks studying at various levels
– the flows leaving the educiational system

These stocks and flows can also be differentiated as to what type of educational programme the students follow, where they live and where they go after leaving the educational system and whether they leave with or without a certificate. In part 2 we will indicate the development of enrolment rates in primary, secondary and post secondary education for age-group 7-29 years as well as the proportion of relevant age-groups passing certain examinations. Regional differences in educational facilities and educational participation will also be briefly considered.

In part 3 absolute numbers will be reported as to total stocks of students at different levels and flows leaving the system. The educational orientation of those entering, leaving and studying at different levels will be dealt with in part 4. In part 5 the drop--out phenomenon is described as well as the amount of educational reorientation that occurs.

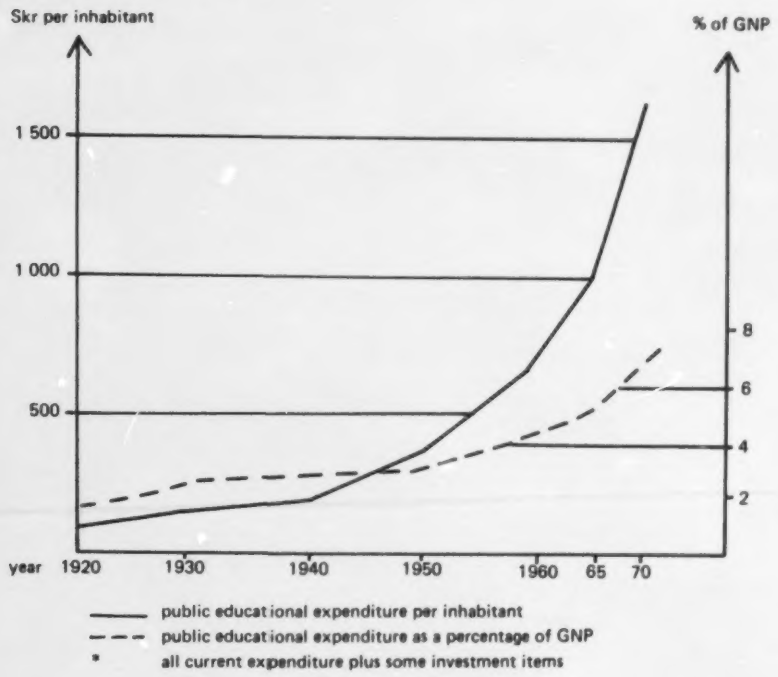
Those who leave the educational system with a certain type of

education constitute an increment to those already in the population with such an education. Permanent changes in the output of the educational system only slowly affect the educational composition of the population. In part 6 we describe what has happened so far in this respect and what can be expected. The last part of this section will be devoted to international comparisons.

2.1 Public educational expenditure

The increase in public expenditure on education is illustrated in graph 1. Its share of GNP is also indicated. After the Second World War an accelerated growth has taken place and in 1970 the share of GNP was 7.2%. During that period the proportion of public expenditure devoted to education also showed an increasing trend which had not been the case earlier.[22)]

Graph 1. Public educational expenditure on "current account"* per inhabitant and as a percentage of GNP, 1920–1970



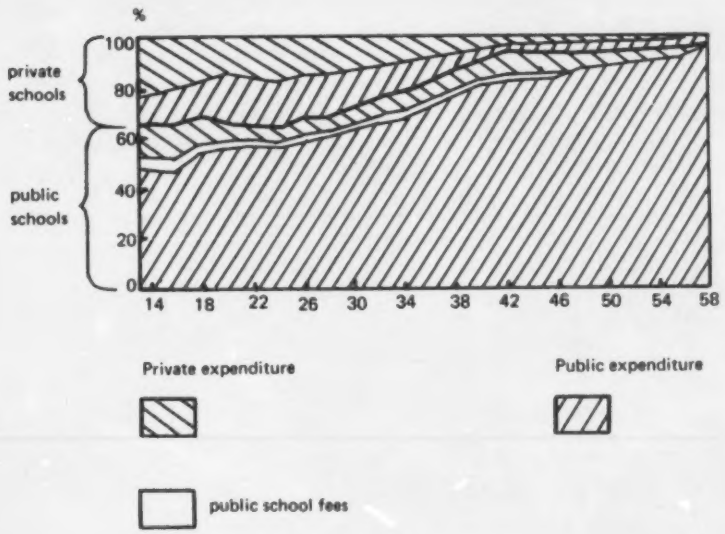
Source: Levnadsförhållanden. Årsbok 1975. SOS. Sthlm 1975 p 139

Given the state of statistics it is not possible to analyse the development of public expenditure on education in any great detail. Let us, however, cite some results from an investigation covering the period 1913-1958. Four types of education can be distinguished: compulsory, vocational, secondary and higher education.

The absolute increase in public consumption expenditure on education mainly stems from the expansion of compulsory education. Next in importance is secondary education followed by vocational and higher education. The relative increase in expenditure was greatest on vocational training while the growth rate of the other three types was about the same. At the compulsory level expenditure grew mainly due to increased costs/pupil, caused by a successive reduction in class-size. During the 50s, however, the effect of increased numbers of pupils was also of some importance for the development of costs at this level. The increased expenditure on secondary and higher education can mainly be explained by an increased number of students.

As for the secondary school the development of public and private financing is illustrated in graph 2.

Graph 2. The financing of running expenses at secondary schools



Source: E. Höök: Den offentliga sektorns expansion. Uppsala 1962 p 170

In 1913 a good 60% of the running expenses were covered by public expenditure. In 1958 the figure was almost 100%. If private expenditure had remained at the same absolute or relative level as in 1913 public expenditure would have been respectively 1% and 36% lower in 1958. This growing importance of public expenditure was caused by an increased number of public schools, a reduction of private spending on

public schools and an increased public financing of the dwindling number of private schools.[22]

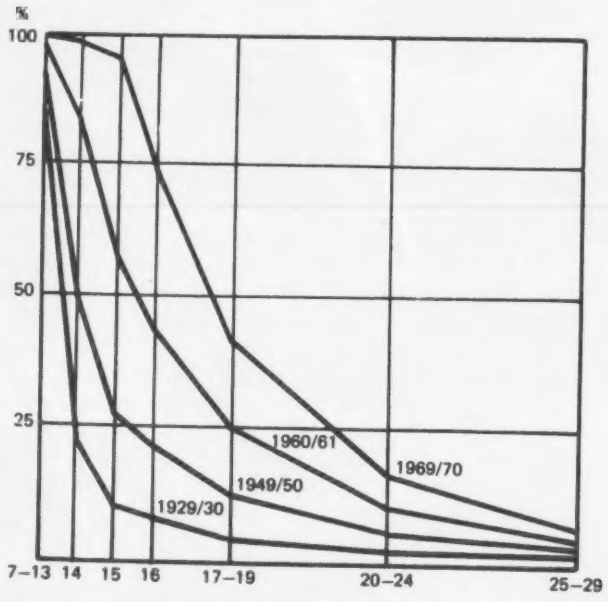
In 1970 another investigation[23] shows the following relative distribution of public (consumption and investment) expenditure on education:

compulsory education	57
upper secondary education	25
higher education	16
adult education	2
	100 %

2.2 Enrolment rates

The development of enrolment rates is shown in graph 3. During the period 1930-1950 the increases were relatively moderate. However, in the 7-24 age group the enrolment rates doubled. 1950-1970 the enrolment rates in the 15-29 age group trebled. The proportion of 14-year old persons in education was already so high in 1950 that more than the actual doubling was not possible. If we compare the 50s and the 60s enrolment rates grew more during the 50s for the 14-year old persons and more during the 60s for all other age-groups. During the early 70s enrolment rates have continued to grow in age-groups up to 17 years, decreased in age-group 18-23 and remained constant in age-group 24-29.[24]

Graph 3. Proportion of ages 7–29 in education



Source: SCB. Trender och prognoser. IFP 1974:8 p. 78, 269, IFP 1972:10 p 29

Judged by the enrolment rates of 14-year old persons the seventh compulsory year was not realised until after 1960. In the 7-13 age group the rate of participation approached, however, 100% already in 1950. In 1972 almost all 15-year old and 75% of the 16-year old persons were in school. In higher age-groups the propensity to study declines rapidly. By 18 it is under 50% and by 19 under 25%.

The types of education not covered by the above statistics are:

1. education in the family
2. pre-primary education
3. education of youth in publicly not supported institutions
4. vocational and non-vocational education of adults by ordinary or special adult educational institutions and firms.

The quantitative volume of the educational activities mentioned under 1. and 3. is not possible to estimate. The schools referred to under 3. are, however, relatively few.[25] As for pre-primary education it was estimated that in 1970 30% of the children 3-6 years old went to day-nurseries or nursery schools.[26]

A rough estimation of adult education provided by firms and special educational institutions for adults has been made.[27] The approximative enrolment rates (relating the full-time equivalents of these adult students to persons 30 years or more) were:

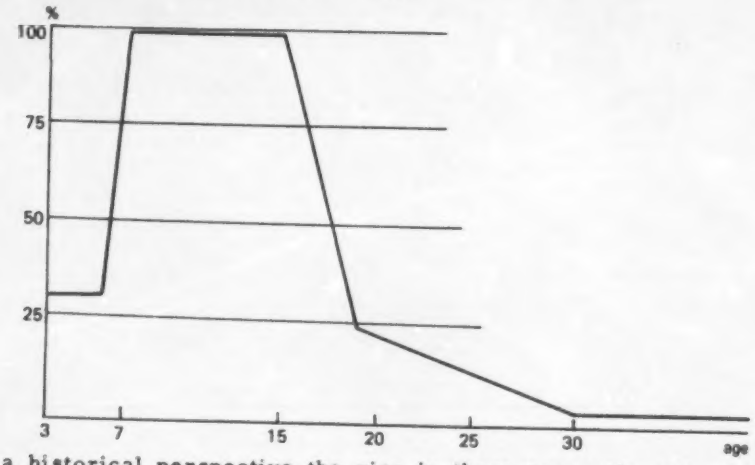
1967	2-3%
1970	3-4%

Adding the adults (30 years old and more) in secondary schools and at universities and specialised university colleges changes these figures by less than one percentage point.[28] The break through for these types of adult education seems to have been the 1960s even through still only a very small fraction of the potential recruitment base is affected.

Figure 2 summarises our information on enrolment rates and indicates the political options as to further educational expansion: more pre-primary education, more education for youth 16 years and older or more adult education.

To further illustrate the development of educational frequences graph 4 has been added. It shows the proportion of an age-group taking university degrees, passing the Higher Leaving Certificate or similar (general academic, commercial and technical gymnasia and corresponding lines in the integrated upper secondary school) and taking the "realexamination" or similar (lower secondary school).

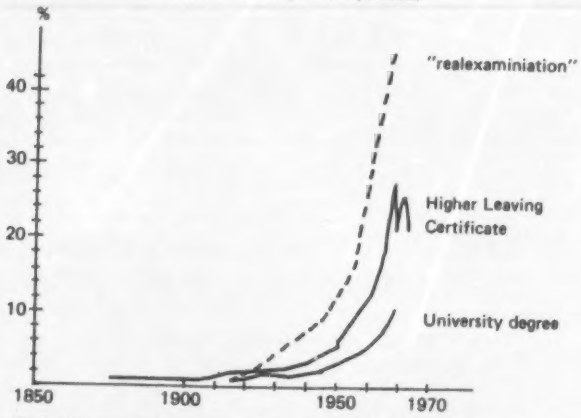
Figure 2. Approximative enrolment rates in the 1970s



In a historical perspective the rise in these proportions stands out as overwhelming and very concentrated in time. The expansion starts in the 20s with the "realexaminations", in the 30s with the Higher Leaving Certificates and in the 40s with the university degrees. Once the expansion started it accelerated up to the late 60s. Thus 10% were taking a university degree by the late 60s. Although this means a great increase compared with the 1% at the beginning of the century one can hardly talk about any mass higher education yet.

For the Higher Leaving Certificate (or similar) the graph contains information up to 1973. There it can be seen how the acceleration is broken and the proportion gaining this certificate starts to fluctuate. - It can be added that an increasing share of the holders of the Higher Leaving Certificate and of university degrees are women even though they still do not make up 50%. 29)

Graph 4. Percentage taking university degrees (in relation to 25-year old persons), passing the Higher Leaving Certificate or similar (in relation to 20-year old persons), taking the "real-examination" or similar (in relation to 16-year old persons)



Soruces: IFP 1974:8 op cit p 54. Levnadsförhållanden. Årsbok 1975 op cit p 134

Finally a few words about the regional supply of education (figure 3). In 1973/74 there were on the average 93 places for beginners in the upper secondary schools per 100 16-year old persons. One fourth of the 16-year old persons lived in counties with a frequency of places lower than 85 % and one fourth in counties with a frequency over 102 %. It may be surprising to learn that the highest frequencies are found in northern Sweden and western middle Sweden. These parts of Sweden are less industrialised and characterised by high unemployment. The migration out of these regions may to a certain extent be responsible for this relative educational abundance. It can, however, also be interpreted as part of a labour market policy creating "employment" in the short run and possibly growth in the long run. It is above all the relatively high supply of places in vocational lines that causes the high frequencies. Places in lines corresponding to the old gymnasia are most frequent in the counties of Stockholm and Uppsala. However, even though the number of places in northern Sweden is relatively high this does not prevent the distance to these educational places from being longer there than elsewhere.[30]

Figure 3. Regional supply of places in upper secondary schools[1] 1973/74

[1] Places for beginners as a percentage of 16-year old persons

Sources: IFP 1974:8 op cit p 89

As to the regional propensity to utilise educational facilities (either within or without the region) it can be noted that in the beginning of the 70s it was, as far as university education goes, higher in regions with a university or a branch university than in regions without. These regional differences in the propensity to go to university disappeared, however, when only those who had just completed 3- and 4-year courses in upper secondary school were compared.[31]

2.3 Development in absolute numbers

In 1973 1.4 million students were enrolled of which 1 million at the "pre-upper secondary" level, 230,000 at the upper secondary level and 150,000 at the post-secondary level.[32]

As for the development of compulsory education it can be noted that there were fewer pupils in such education in 1940 than in 1930. This was due to a decreasing size of the relevant age-groups. The size of the age-groups beginning primary school when the seventh compulsory year was introduced (1936-1948) first continued to decline and later began to increase but remained relatively small. Therefore, in 1950 there were only 65,000 pupils more than in 1940. During the 50s the size of the age-groups continued to rise and stayed large at the same time as the length of compulsory education was extended to nine years. Consequently during the 50s the number of pupils at what now might be called the "pre-upper secondary" level expanded very substantially. During the 60s and the beginning of the 70s the number of pupils remained at a high but somewhat fluctuating level.[32]

The wave of cohorts of increasing numbers reached the upper secondary schools during the 50s and the beginning of the 60s. They were on an average larger in the 60s than in the 50s. The increase in the recruitment base but above all the increased propensity to study at this level made for an expansion of the number of students during the 50s and especially during the 60s. Also for higher education the expansion was greater in the 60s than in the 50s due both to a greater propensity to study and increased age-groups. Declining propensity to study combined with smaller groups of relevant age led to a reduction of student numbers during the beginning of the 70s.[32]

The growth in student numbers after 1950 looks as follows:[32]

	1950-60	1960-70	1970-73
"pre-upper secondary"	285,000	-50,000	40,000
upper secondary level	70,000	110,000	± 0
other vocational education	15,000	10,000	-5,000
university level	20,000	85,000	-15,000
Total	390,000	155,000	20,000

On the whole the expansion was strongest during the 50s and above all due to the expansion of the "pre-upper secondary" level. The expansion during the 60s was caused by increased numbers in upper secondary and post-secondary education. 1970-1973 only the "pre-upper secondary" level continued to grow.

To this can be added the numbers in pre-primary education which were:[26]

1960	49,000
1970	111,000

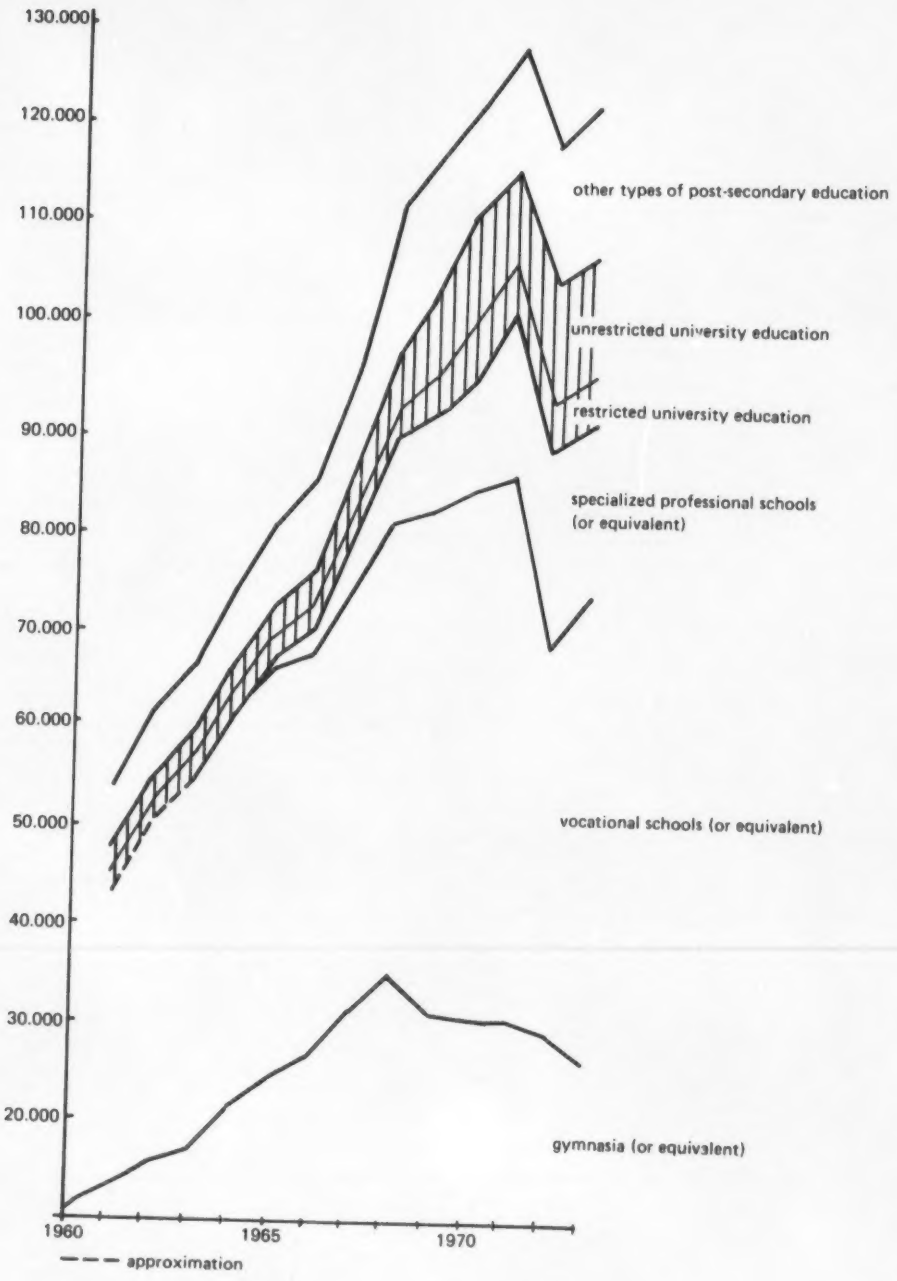
The number in adult education was estimated in 1970 to have been equivalent to 150,000 persons on a full-time basis.[27] This figure does not include adults in educational institutions normally providing education for youth. In 1972 the number of persons in upper secondary schools older than 30 years was 3,300.[28] 24% of the students at universities and specialised university colleges were over 30 years in 1973 which corresponds to about 26,000. In 1962 they were only 7,000. Moreover 16% of the new entrants to university and specialised university colleges in 1971 lacked the normal secondary school qualifications. Some adult education thus also takes place at secondary schools and universities.[28]

As the number of persons obtaining degrees and certificates might reasonably be inferred from the development of enrolments we will restrict ourselves to presenting some details about the examination at levels above the comprehensive school level 1960-1973.

As can be seen in graph 5 the number of pupils completing their secondary education and students taking examinations and degrees at higher educational levels reached a maximum in 1971 when 128,000 persons passed final examinations (or equivalent) at these levels. For the gymnasia (general academic, commercial and technical) the number of Higher Leaving Certificates awarded was at its height in 1968 whereas the expansion in vocational schools continued up to 1971 and in other types of educations up to 1972, with the exception of restricted university education which expanded albeit slowly throughout the whole period.

The number of persons leaving the educational system with certificates, degrees or similar was twice as high in the beginning of the 70s as in 1960. Out of the increment of 60,000 the upper secondary school stood for 40,000, university and specialised university colleges for 11,000 and other post-secondary education for 9,000. Relatively speaking the expansion was greater at the post-secondary levels than at the upper secondary level.

Graph 5. Number of pupils completing their upper secondary education, examinations and degrees taken at hihgher educational levels



Source: IFP 1974:8 op cit pp 278–289

2.4 Orientation of studies

The upper secondary school integrates the gymnasia, the specialised professional schools and the vocational schools. The former are more theoretically and the latter more practically oriented. The distribution of students over these three types of education (later lines of the integrated upper secondary school) therefore has something to say about the structure of the educational expansion. It looks as follows:[33]

	1950	1960	1970	1973
Gymnasia	71	57	48	42
Specialised professional schools	-	-	17	17
Vocational schools	29	43	35	41
	100%	100%	100%	100%
Total number	43,000	116,000	224,000	226,000

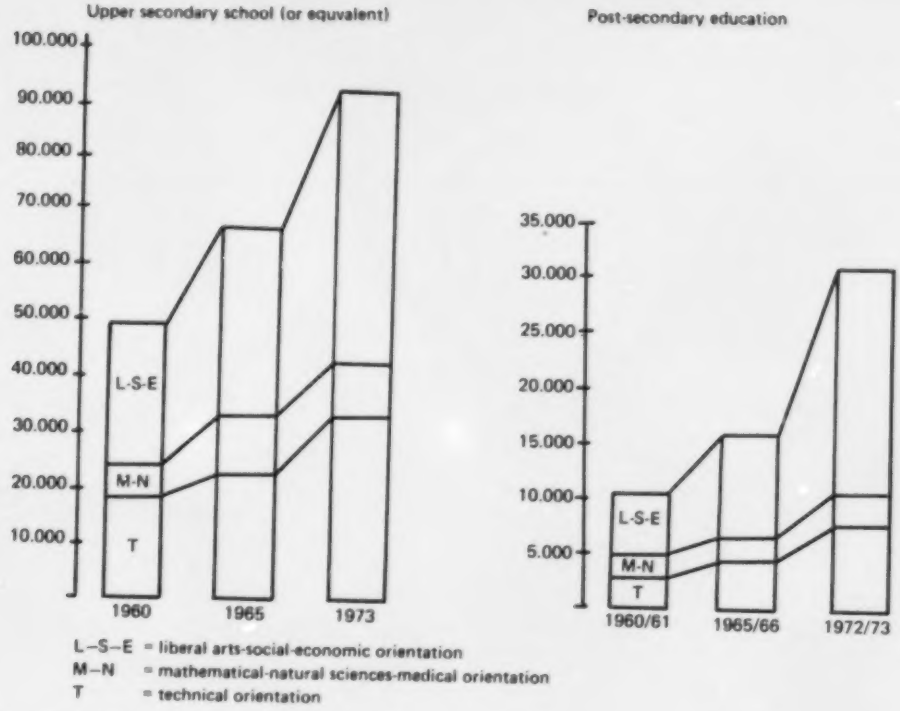
While the gymnasia had 70% of the pupils in 1950 by 1973 the situation had changed so that the lines in the upper secondary schools corresponding to the specialised professional schools and the vocational schools had 60% of the pupils. Thus, in 1973 a greater proportion of students at this level gets a practical vocational education.

If we again consider the different types of education at the post-secondary level that were distinguished earlier, that is restricted and unrestricted university education and other post-secondary education, we can characterise them in the following way. Restricted university education gives longer vocationally oriented education. Other post-secondary education gives shorter vocational training while the unrestricted university education is less directly vocationally oriented. In the beginning of the 70s the two former types of higher education stood for 2/3 of the degrees (or equivalent) and the latter for 1/3. These proportions were about the same as in 1960.

In graph 6 the pupils completing their upper secondary education and examinations and degrees taken at higher educational levels have been classified after their subject-matter orientation into three sectors: the liberal arts-social-economic-(L-S-E-), the mathematical-natural sciences-medical-(M-N-) and the technical-(T-) sectors.

For the upper secondary level it is noted that of these sectors the L-S-E-sector expanded most in absolute numbers but this did not lead to more than an increase from 51% to 54% of the secondary school leaving certificates (or equivalent). The share of the T-sector remained stable while that of the M-N-sector declined slightly. Among the new

Graph 6. Pupils completing their upper secondary education and examinations and degrees taken at higher educational levels by educational orientation



Source: IFP 1974:8 op cit pp 278–289

entrants to this level the longer and more theoretical lines have recently become less popular. The L-S-E- and the T-sector but not the M-N-sector are, however, represented on the shorter lines. It is thus possible that even in the future these two sectors will increase their share. The decline in students gaining secondary shool leaving certificates on natural sciences lines have already caused cries of alarm. Soon the technical university colleges may only have applicants for half of the places and the natural sciences faculty at general universities none! 34)

At the post-secondary level the L-S-E-sector has grown very rapidly both in absolute and relative terms. While it stood at 50% of the degrees (or equivalent) in 1960 the share was 64% in 1972/73. The L-S-E-sector is thus much more important at the post-secondary than at the upper secondary level. The vocational school with mainly technically oriented education serves as a counterbalance for the latter level. At the post-secondary level the relative increase of the L-S-E-sector has taken place at the expense of both the T- and the M-N-sectors. The share of the former declined from 17% to 11% and that of the latter from 33% to 25%. Judging from information about the orientation of new entrants it is possible

that the share of the T-sector will expand and that of the L-S-E- and M-N-sectors decline in the near future.[35]

It can be added that adults enrolling at the "free" faculties choose the L-S-E-sector to a higher and the M-N-sector to a lower extent than younger students. In 1971/72 80% of the adults enrolling at the faculties of liberal arts, social and natural sciences choose the former two faculties.[36] Women enrolling at universities are strongly overrepresented at the liberal arts faculty and underrepresented at the other faculties.[37]

2.5 Flexibility within the educational system, drop-out and educational reorientation

Politicians have come to realize that a flexible educational system is desirable. It should permit the students a certain freedom of movement and leave possibilities open for educational reorientation. Dropping out, however, was for a long time viewed very unfavourably. This negative view of dropping out of school still prevails as far as the comprehensive school is concerned. As from the school year 1971/72 the educational code further restricts the possibilities to leave the comprehensive school prematurely. Dropping out of school at this level is in conflict with the goal of providing everyone with a common basic education. At higher educational levels the view of dropping out has changed. It has been recognised that dropping out is not always equivalent to a waste of resources. A flexible educational system may necessarily be characterised by what statistically shows up as high drop-out rates. Partial studies can form a link in a process of recurrent education or be part of an information and decision making process. Moreover, in incomplete statistics educational reorientation will, to a certain extent, be labelled drop-out.[38] "Drop-outs" and partial studies caused by recurrent education and even to a certain extent by vocational and educational reorientation is by now politically accepted and even stimulated at higher educational levels.

Let us now indicate the magnitude of the drop-out and reorientation phenomena.

The drop-out rate in grade 9 in the comprehensive school around 1970 has been estimated at 1-4%.[39] This is much less than the figures for the old lower secondary school. An investigation from the mid-fifties showed that 25% of these pupils never did take the "realexamination" and that another 25% only passed with a certain delay.[40] Quantitatively all but a small minority nowadays receive 9 years of education. What they qualitatively get out of this education is of course more difficult to evaluate. As one piece of information it can be mentioned that in one study it was estimated that about 15% of the pupils leave grade 9 without being able to read, write or calculate better than the average pupil in grade 6.[41]

At the upper secondary school a longitudinal study found that at the beginning of the 70s 15%, 7% and 5% of those who turned up in grade 1, 2 and 3 respectively dropped out during the year. The drop-out rate was lowest for the 3- and 4-year theoretical lines. These latter drop-out rates are also probably lower than those of the old gymnasium.[42]

Of those who enrolled at universities and specialised university colleges 1956/57-1961/62 about 70% took a degree within 11 years. Of these students 10% obtained their degrees at faculties other than that of enrolment. 5% were still studying after 11 years and 25% had left without any degree. Comparing these drop--out rates with those of students enrolled later (1962/63-1969/70) it was found that the proportion of the later students who had left without any degree already after three years surpassed that of the earlier ones after 11 years (30% as compared with 25%). This tendency towards higher drop-out rates mainly characterised the unrestricted university education. The level of the drop-out rate is also much higher for this type of education than for that with restricted entry. At faculties of liberal arts, natural sciences and social sciences 60% had taken a degree after 11 years as compared with 80-90% (sometimes 100%) in restricted university education. These frequencies of the 60s at unrestricted university education does not represent any improvement compared with those of the 50s when a certain numbers of measures were taken to counteract what was then considered to be very high drop-out rates.[43] As was just mentioned these drop-out rates are, however, no longer regarded as unfavourably as before. To a certain extent the recent increases in the drop-out rates may only represent a temporary phenomenon. The factors that caused a general decline in university enrolments may also have provoked a higher propensity to leave the universities. Both among younger students and students with a declared intention to take a degree, very high, and increased, drop-out rates have been noted. This may be temporary. The proportion of students with the declared intention not to take a degree has, however, increased in unrestricted university education. In 1973 it was as high as 50% among those enrolling at the faculties of liberal arts, natural and social sciences. This fact points to a structural change. It can to a certain extent be explained by the increased share of older students. A greater proportion of them normally leave without taking any degree[44] and in this case the drop-out could be interpreted as recurrent education.

The amount of educational reorientation is more difficult to evaluate. Therefore a few examples will only be given. Above was indicated that a certain number of students (10% during the period studied) gained their degrees at faculties other than that of enrolment. This flow mainly consists of students enrolling at the free faculties and ending up in restricted university education. For those who left upper secondary school before 1969 it is possible to improve the secondary school merits by studies at the free faculties. Because of the changed rules this educational route has

and probably will continue to loose in popularity. However, even in the future it will certainly be used by some students (see below) and remain as an expression for true educational reorientation.[45]

Let us now cite the results of a follow up study of a number of new entrants in 1968 and 1971 at the free faculties in the University of Umeå.[46] When enrolling, 70-80% declared that they had the intention to take a degree. After 3 years more than 50% of the students had altered study and/or vocational plans. Changes in "external" factors (labour market and educational possibilities) dominated as explanations for these amended plans. The changed plans materialised in three ways:

1. Transfer to other types of education. After 9 terms 30% had moved to other educational institutions. This flow of students was not only directed towards restricted university education and university institutions in other regions but nearly as often towards educational institutions outside the university sector. As for restricted university education 15% of the students stated that they had earlier asked for admission to restricted university education but only 8% motivated their studies at the free faculties by not having been admitted at restricted university education. 60% planned to ask for admission to such education later. Half of them could, however, not state exactly what type of education that would be.
2. Transfer to the labour market without having taken a degree. For some of the students this had been planned in advance but for many of them this was a reaction upon labour market signals.
3. Changed educational programme. At the end of the first year, on the average, 50% of the students had left the educational programme they originally enrolled for.

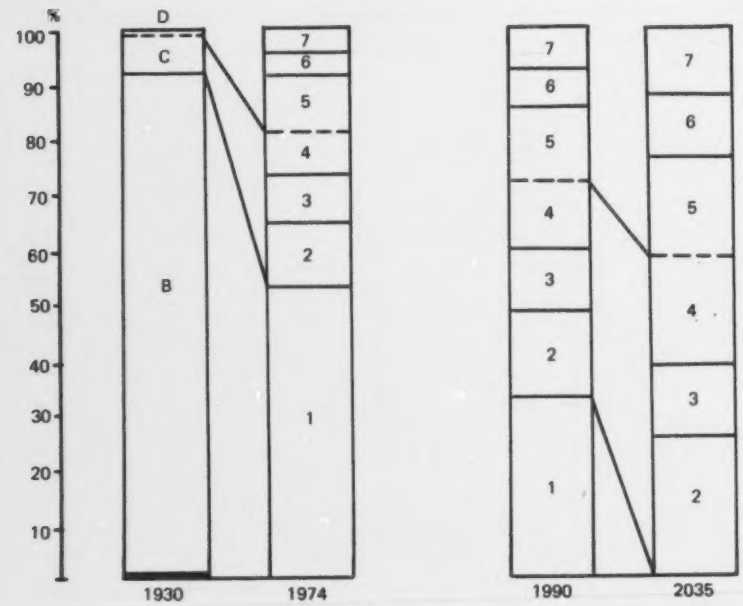
This information indicates that the educational system has an allocative function to fill during the educational process. To answer the question whether this function as well as that of providing possibilities for recurrent education are well filled would require more detailed investigations.

2.6 Effects of the expansion on the educational composition of the population

Graph 7 shows to begin with the educational composition of the population in 1930 and in 1974. It is noted that in 1930 only about 1% had passed the Higher Leaving Certificate or taken a higher degree (educational category D). The majority of the population (90%) had only primary education, and 1% had no

registered education at all. The differences between the generations making up the 1930 population are very small at higher educational levels. The percentage with no registered education, however, decreases from about 10% in the oldest age-group to 0 in the youngest groups. For the older primary education also more often implies fewer years of education.x) The development, during the period these generations (born 1860-1910) represent, is above all characterised by the spread and consolidation of the primary school.

Graph 7. The educational composition of the population over the age of 15 in 1930 and the population aged 20–74 in 1974. "Projections" for 1990 and 2035



Educational categories:

- no registered education
- B primary education and shorter vocational training
- C lower secondary education and longer vocational training
- D Higher Leaving Certificate or higher degree

1 Pre-upper secondary education less than 9 years

2 Pre-upper secondary education 9 (10) years

3 Upper secondary education 1 year or less

4 Upper secondary education 2 years or less but more than 1 year

5 Upper secondary education more than 2 years

6 Post-secondary education 2 years or less

7 Post-secondary education more than 2 years

Sources: Levnadsförhållanden. Årsbok 1975 op cit pp 123, 124 IFP 1974:7, 1974:8 op cit p 269

x) Educational category B comprised in reality persons with 1-8 years of education.

In 1974 19% of the population belong to educational categories 5-7 which approximatively correspond to category D in 1930. This represents thus a rather important educational expansion. However, still only 9% have post-secondary education (level 6 and 7) and about 50% have only an education shorter than 9 years. 28% are found at the middle educational levels 2-4. Comparing the generations making up the 1974 population it can be noted that the intergenerational differences are very pronounced. As for educational categories 3-7 (upper secondary schooling or more) an important jump occurs between those born 1900-1907 and 1908-1924. Among the former, 13% belong to these educational groups and among the latter 24%. The proportion belonging to educational category 7 (post-secondary education longer than 2 years) is about the same for these generations (3%) but increases to 7% among those born 1925-1939. The younger generations are much more evenly distributed over educational levels than the older generations.

It can be added that on the average the education of women is somewhat shorter than that of men, 33% of the women belong to educational categories 3-7 which may be compared with 39% of the men.

Finally the "projections" made for 1990 and 2035 (graph 7) should be commented upon. They have been produced as an aritmethical example to show how slowly the educational composition of the population changes even though the education of youth may have expanded heavily. We have assumed that the high enrolment rates of 1972 become permanent and that people older than 20 years do not receive any further education. Our calculations thus only illustrates the effect of expanded education of youth permanented at the 1972 level. In 1990 only the 20-35 age group is new compared with 1974. Not until 2035 are all age-groups new and then the whole population would have received the same amount of education as the young in 1972. Thus in 2035 75% of the population would have more education than comprehensive school and 40% belong to educational categories 5-7.

2.7 International comparisons

Many problems arise when international comparisons of education are to be made. The OECD has, however, prepared statistical data describing the present situation in different countries, taking pains to apply uniform classification norms.[47] We will, to a large extent, base our observations on that material. The aspects we will deal with are: educational expenditure, enrolment rates within different age groups and at different educational levels and finally the population by educational levels.

Educational expenditure

The annual growth of total public expenditure on education was,

in Sweden, rather high during the period 1965-70 (15%) but compared with other countries it was not exceptionally high. It was, however, sufficiently high compared with the growth in GNP to permit Sweden to advance from a shared third position (together with Canada) in 1965 to the second position (after Canada) in 1970 ranking the countries after the share of public educational expenditure in GNP. Sweden thus devoted 7.7% of GNP to education in 1970. The range of this share in the OECD countries was 2.0 - 8.3%.[50]

In certain countries there exists, contrary to Sweden, a fairly important private educational sector. In the U.S.A. and Japan, for example, private educational expenditure amounted to 20% of the total (public and private) educational expenditure in 1970. If the private expenditure is included the share of GNP devoted to education in the U.S.A. (7.4%) becomes more comparable to the Swedish expenditure.[50]

Enrolments

To get an overview of the amount of education received in various age-groups around 1970 in different countries table 1 can be studied. The average number of years of full-time education received in the 3-6 age group is very low in Sweden. To a certain extent this is due to the fact that compulsory schooling only begins at 7 in Sweden. Among countries similar to Sweden in this respect only the U.S.A. gives more education to the 3-6 year old children.[51] As for the 7-14 age-group most countries (including Sweden) have an average of 7.8 - 8.0 years. If we look at the next age-group (15-18) only Canada, Norway and the U.S.A. have a higher average than Sweden. Japan is on the same level as Sweden (2.7 years). The average in the oldest age-group is somewhat higher in Finland, Norway, the U.S.A. and Yugoslavia than in Sweden. Despite the high Swedish ranking for older age-groups the overall average for the 3-25 age group is higher in several countries (e.g. Belgium, France, Japan, the Netherlands and the U.S.A.). Canada and Ireland have about the same average as Sweden.

In graph 8 the enrolment rates in Sweden and the U.S.A. can be compared both around 1950 and 1970. The expansion in enrolment rates has continued in the U.S.A. after 1950 but it has been much quicker in Sweden with the result that Sweden is much closer to the U.S.A. around 1970 than 1950.

In the figures above different types and levels of education were not distinguished. It can be useful to report some figures of that kind too. If we start with higher education (both university and non-university type) the enrolment ratio in Sweden was 23% in 1970. This figure is surpassed only by Canada (39%) and the U.S.A. (43%).[52] A corresponding figure for the Soviet Union can be added. In 1968 the enrolment ratio for higher education (day, evening and correspondence education) was 30%.[53]

Table 1. Average years of full-time education received per head of population in age-groups cited and average total. Expectation of education around 1970

		Average years of education received between ages:				
		3-6	7-14	15-18	19-25	Total 3-25
Australia	1971	2.2	8.0	2.0	n.a.	n.a.
Austria	1969	1.8[a]	8.0	1.3	0.5	11.6
Belgium	1966	3.8	7.8	2.2	0.7[b]	14.5
Canada	1968	1.3	7.8	2.9	0.8	12.8
Denmark	1970	0.6	7.8	2.1	0.9	11.4
Finland	1967	0.3	7.9	1.9	1.3[c]	11.4
France	1970	3.5	7.9	2.2	0.7	14.3
Germany	1969	1.8[a]	7.8	1.2[c]	0.6	11.4
Greece	1968	1.1	7.0	1.6	n.a.	n.a.
Ireland	1971	2.6	7.8	1.9	0.5	12.8
Italy	1966	1.5	7.0	1.2	0.4[b]	10.1
Japan	1970	(2.0)	(8.0)	(2.7)	(0.5)	(13.2)
Luxembourg	1970	2.6	7.5	1.5	0.6	12.2
Netherlands	1970	2.8	7.9	2.1	0.7	13.5
Norway	1970	(0.2)	7.9	2.8[d]	1.2[b]	12.1
Portugal	1970	(0.3)	6.5	0.9	0.6	8.3
Spain	1970	2.2	7.2	1.1	0.7	11.2
Sweden	1972	1.2[a]	7.9	2.7	1.1	12.9
Switzerland	1970	(1.6)	7.7	2.5	0.3	12.1
Turkey	1968	n.a.	6.1	(0.8)	n.a	n.a.
U.K.	1970	2.3	8.0	1.6	0.4[b]	12.3
U.S.A.	1970	2.3	7.9	3.3[e]	1.3[e]	14.8
Yugoslavia	1968	(0.5)	6.9	1.5	1.3	10.2

N.B. In many cases education in special schools for handicapped children is excluded.

a 1970

b 19-24

c Excludes part-time compulsory vocational schools

d Includes a very small number of part-time pupils

e Full and part-time

( ) Estimates

Source: OECD Educational Statistics Yearbook Volume 1. Paris 1974 p 14

For the university part of the higher educational system a few additional observations can be made:

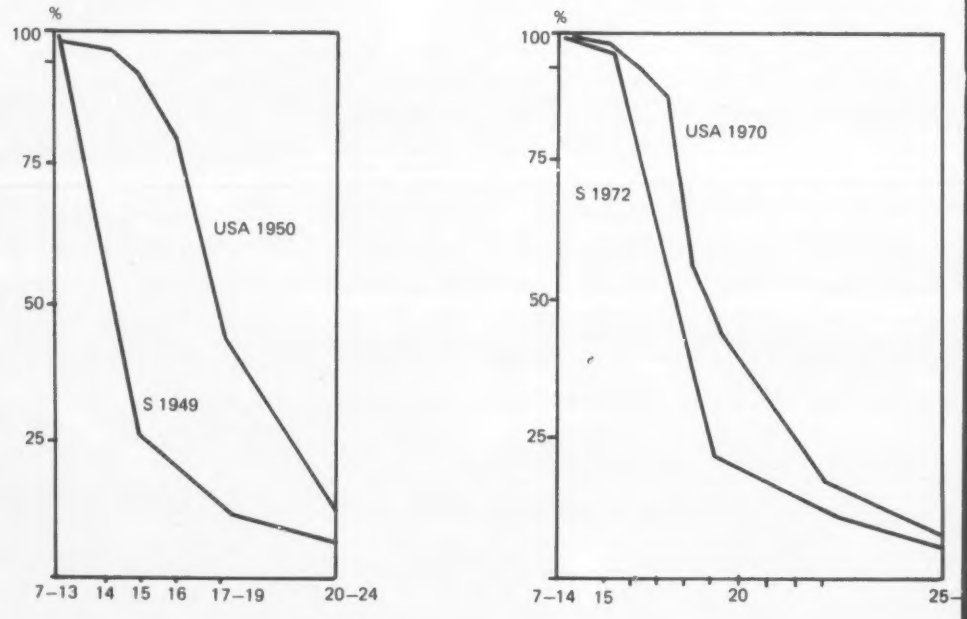
In 1970, 37% of the university students in Sweden were women. The same year the proportion of women was higher in Finland (48%), France (45%), Italy (38%), Portugal (45%), Yugoslavia (38%) and the U.S.A. (41%).54)

The number of graduates obtaining a first degree in university type of education as a percentage of a single-year age-group was 11% in Sweden, a figure that not surprisingly is surpassed in Canada (19%) and the U.S.A. (27%). Japan is at about the same level as Sweden. These figures are from 1970.[54]

Enrolments and future number of graduates are influenced by the development of new entrants. The number of new entrants has declined in Sweden since 1969 and enrolment gone done as we earlier noted. Only for certain countries do we have information about the recent development of new entrants to university type of higher education. The number of new entrants has increased in Australia, Belgium, Canada, Denmark and Finland up to 1972. For Ireland and the U.S.A. there has been a decline in the number of new entrants from 1971 and 1970 respectively.[55]

Even though the number of new entrants started to decrease in 1969 in Sweden it was not low compared to other countries in 1970 (the last year for which complete information about the OECD countries has been published). The annual entry to university type of higher education as a percentage of the relevant age-group was 31% in S·eden in that year. This figure is actually the highest one noted for all OECD countries that year.[56]

Graph 8. Enrolment rates



Sources: SOU 1955:34 p 95
Educational Statistics Yearbook. Volume I op cit pp 27–30 (with corrections introduced according to Volume II pp 361, 412)

New entrants as a percentage of the relevant age-group to non-university type of higher education is on the contrary not especially high in Sweden. Belgium, Canada, Norway and the U.S.A. have higher percentages. The relative number of new entrants to the whole sector of higher education is, however, only higher in the U.S.A.[56] x)

The expansion of secondary education means that a higher proportion of a cohort completes such education. Among European OECD countries Sweden has the highest rate of transfer to university type of education among holders of general academic secondary school leaving certificates.[57] This might imply that in Sweden alternatives in terms of work and other types of education are relatively less abundant (see above) and attractive and the entry to university less restricted. For most of the European OECD countries (including Sweden) these transfer rates have declined 1965-70.[57] Competition on the labour market and at non-university types of higher education between students who finished secondary school on lines normally preparing for university and students finishing more vocationally oriented lines may thus have increased.

Population and education

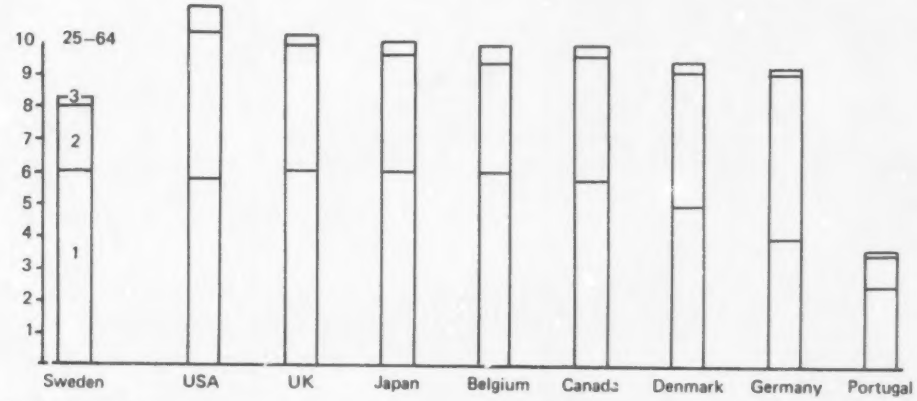
Graph 9 depicts the education in the population in different countries around 1970. The first part of the graph deals with the population aged 25-64. Sweden is found to the left and the other countries follow according to the average education in their populations. Among the OECD countries having a lower average than Sweden only Portugal has been included. Despite the fact that Sweden ranked high in most educational aspects we have treated so far (with the exception of pre-primary education which is not included here) the average education in the Swedish population is rather low. The present output of the educational system is higher in Sweden than in the U.K., Belgium, Denmark and Germany but apparently the educational expansion started earlier in these countries with the result that their stocks of educated are still higher.

The graph also shows the composition of the average consisting of years in primary, secondary and higher education. It is especially at the secondary level that Sweden, so to speak, lacks education. Higher education plays, in this perspective, a minor role in most countries. The normal pattern is that education at the primary level stands for a larger part of the average than education at the secondary level. This is, however, not the case in Germany and Denmark where both these levels have about the same share of the average. This means

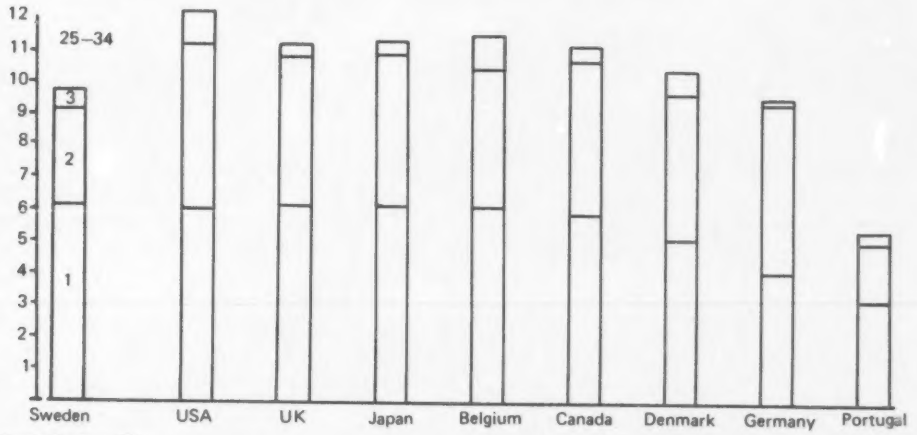
x) The figure for Canada is lower than that for Sweden but probably heavily underestimated.

Graph 9. Average years of formal educational experience of total population aged 25–64, 25–34 and 65–74

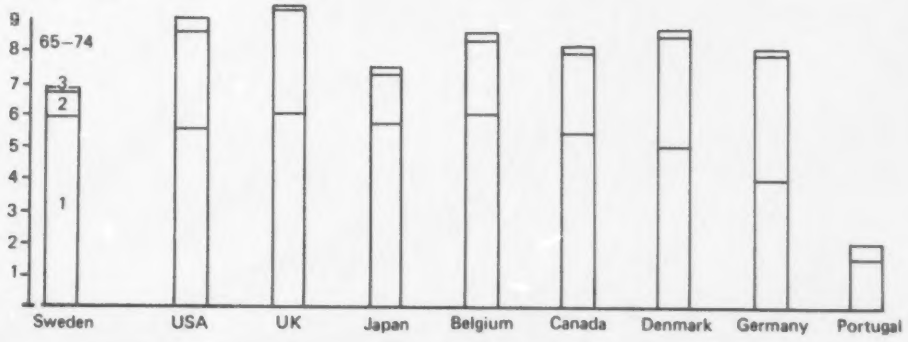
1 = primary education
2 = secondary education
3 = higher education



Graph 9. (page 2)



Graph 9. (page 3)



Source: Educational Statistics Yearbook. Volume I op cit pp 57–59

that in these countries both educational levels must have had a more parallel expansion.

If we look at the 65-74 age-group, not the U.S.A. but the U.K., followed by the U.S.A., Denmark, Belgium, Canada and Germany, has the highest educational average. Here too it is especially secondary education that is low in Sweden while primary education gives a higher average than in Denmark and Germany. For the 25-34 age-group the rank order is again reversed. The U.S.A. has the highest average followed by Belgium, Japan, the U.K., Canada and Denmark. It is this expansion of education in younger age-groups that permits the U.S.A. to surpass the U.K. in the average for the 25-64 age--group. Sweden has a higher average than Germany for the 25-34 age-group but not high enough to have a total average above that of Germany.

The difference in these countries between the 25-34 and 65-74 age-groups mainly consists of secondary education that has expanded.

In most OECD countries the education of women is shorter than that of men. Two exceptions can, however, be mentioned: Ireland and the Netherlands. In the former country the average education of women is higher and in the latter the same as that of men.[58)]

Considering the present volume of educational activities the OECD made projections for the development of the average education in the populations. Sweden is expected to have a faster growth in the average than countries with a higher average at present so the differences can be expected to diminish.[58)]

3 Education and allocation

Given the organisational and quantitative development of the educational system just described what have been the effects of this upon allocation, growth and distribution of income and welfare? This section and the next one are intended to bring forth empirical material that can tell us something about what has happened in these areas. The interpretation of the data will be discussed in the last section. While section 4 contains data mainly relevant from a distributional point of view this section is devoted to allocative aspects, that is how different educational groups have been utilised on the labour market. The changing position of different educational groups on the labour market will be described. Some data are also provided that may be useful when a link between education and economic growth at an aggregate level is sought. First, however, a brief summary of the general development of the Swedish labour market is given.

3.1 Some generalities about the Swedish labour market

Labour market organisations[59)]

The Swedish labour market is highly organised. Three labour unions - the Swedish Confederation of Trade Unions (LO), the Swedish Central Organisation of Salaried Employees (TCO) and the Swedish Confederation of Professional Associations (SACO) - dominate the picture. Broadly speaking the LO members have only compulsory education while the SACO members are typically university graduates and TCO members have upper secondary education. Centralised wage negotiations between these organisations and the employers organisations (private and public) take place at certain intervals.

For the employees of the public sector salaries are in principal fixed for every position and negotiations center around these salary schedules. Besides the general wage increases obtained in negotiations individual salary increases occurs as a result of automatic individual salary increases and individual advancement from one position to another. New positions are created by the public authorities not the individual agencies th selves.

The private sector does not have these rigid salary schedules. Besides the centrally and locally negotiated wage increases there is the so called "wage drift", wage increases accorded by the employer on top of those agreed upon in negociations

with the trade unions. Especially the LO has pursued a wage policy aiming at decreased wage differentials.

General features

As in many other countries the labour market has been subject to considerable structural changes in the 20th century. The agricultural sector has continuously lost ground employing a smaller and smaller share of the total labour force while the industrial sector has expanded. After 1965, however, the expansion of the industrial sector stopped. Instead the service sector (especially public administration and services) increased. In 1973 56% of the employed labour force worked in the service sector. The public sector stood at half of this employment.[60]

Parallel to, and to a certain extent due to, this change in the sector composition of employment there has been a structural change in occupations away from blue collar and towards white collar jobs. While in 1960 30% of the labour force was engaged in white collar jobs (professional, technical and related occupations, administrative occupations, clerical occupations and sales occupations) the share in 1973 had risen to 45%. Among these groups of white collar occupations the one covering professional, technical and related workers has had the most rapid growth rate during the period 1960-73. The administrative occupations expanded rapidly during the 60s but their share of the labour force declined in the early 70s. Instead, the clerical occupations expanded then.[61]

The size of unemployment has been much lower after the Second World War than before. However, during the 60s and early 70s a tendency towards increased unemployment rates has been observed.[62] During the 60s the relation between unemployment (u) and vacancy (v) rates also seems to have shifted outwards as illustrated in graph 10. This shift seems to have had less to do with changes in the composition of the labour force (by age-groups or sex) than with accelerating business concentration, productivity increases and factor substitution leading to an increased flow of unemployed and a decreased flow of vacancies. The length of the unemployment period thus increased.[62]

This pattern seems to have continued during 1975 (a recession year) as far as decreasing vacancies and longer periods of unemployment are concerned. However, the inflow to the stock of unemployed did not increase with the result that the rate of unemployment actually decreased.

Labour seems gradually to have become much more of a fixed factor of production in Sweden. The tendency towards a decreased flow of vacancies, lower turnover and a growing importance of internal labour markets at the expense of external has been explained by:[63]

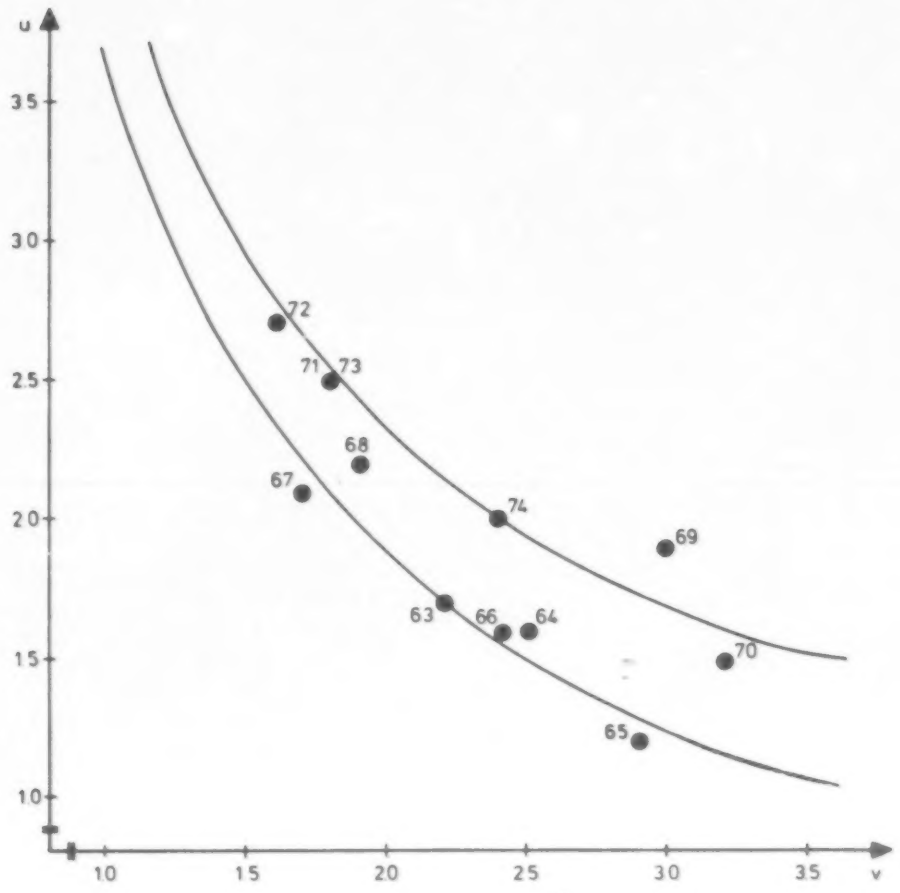
- the growing size of firms

- increased on-the-job training
- decreased incentives for mobility (progressive taxes in combination with smaller wage differentials)
- legislation to increase job security.

These trends, creating an increased security for large groups may lead to problems for certain marginal groups and give rise to a dual labour market. Those who are unemployed experience greater difficulties in finding jobs and have less to choose from.

Internal labour markets with career ladders can create problems especially for unemployed older people and those young who do

Graph 10. Unemployment (u) vacancy (v) rates in Sweden 1963–1974



Source: B Holmlund: Arbetslöshet och lönebildning Umeå 1976 p 82

96

not manage to get in. This may, however, be more of a problem for white collar employees than for workers.[64]

As for regional differences, persistant, large, and relatively constant, differences in the rate of unemployment have been observed. Northern Sweden shows the highest rate of unemployment and an u-v curve furthest from the origin.[65]

Differences also exist between demographic groups. In many respects, however, the situation on the labour market of women and the young are similar. Compared with middle aged men both groups:[66]

- have higher rates of unemployment
- do more part-time work
- dominate relatively speaking the groups that look for jobs on the external labour market
- are more mobile in and out of the labour force.

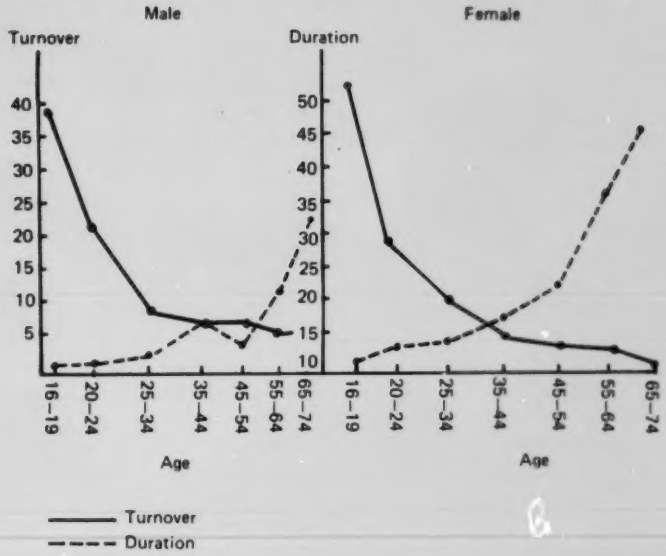
However, the development by age of turnover or risks of becoming unemployed and unemployment duration once unemployed is the same for men and women as can be seen from graph 11. Unemployment for the young is of short duration but occurs more frequently. The opposite is true for the older, both men and women. Studying different groups of unemployed it has been found that those who had lost their jobs had a longer unemployment duration than those who entered the labour market or were unemployed for other reasons. (These three groups accounted for approximately 1/3 each of the unemployed).[66]

It can further be noted that the unemployment rates of the younger age groups are much more sensitive towards changes in the level of economic activity. Their rate of unemployment rises quickly and only slowly goes down as the economy recovers.[67]

Another demographic group that in many countries experience a special labour market situation is immigrants. In Sweden they make up approximately 5% of those gainfully employed. They seem:[68]

- to be overrepresented among workers and underrepresented among employees and business owners
- to a higher, and increasing, degree work in industry
- to be more mobile
- to be underrepresented in both low and high income classes
- as an average to have the same rate of unemployment as Swedes. However, their rate of unemployment fluctuates much more strongly. When unemployment goes up it rises much more quickly for immigrants. To a certain extent they and the young can be said to be marginal groups with less secure jobs
- to a lower degree have a job that they think themselves best suited for (69% versus 97% for Swedes).

Graph 11. Turnover and unemployment duration 1972



Source: N S Barrett, B Södersten: Uemployment Flows, Welfare and Labor Market Efficiency. The Swedish Journal of Economics 1975:3

However, they are not overrepresented among occupational groups that are characterised by especially low wages. Their first occupation may often have been less attractive but later they have been able to change.[67]

Judging from these labour market data women, the young and immigrants seem to a certain extent to experience a different kind of labour market situation than middle-aged men. We will later present some data to indicate what the role of education may be in these respects.

However, to get a further perspective on the Swedish labour market let us first make a few comparisons with the U.S.A.[69] 1965-70 the Swedish labour market was characterised by lower rates of unemployment than the American one. However, there seems to be less mobility on the Swedish labour market. Turnover is lower. Swedish workers change jobs less frequently. Fewer are unemployed but those who are remain unemployed for a longer period of time. Moreover, in the U.S.A. the relationship between turnover and unemployment duration is not the same as in Sweden. Both turnover and duration decrease by age. The low mobility on the Swedish labour market seems to have further decreased in the early 70s.

3.2 Labour market utilisation of different educational groups

Labour force participation[70)]

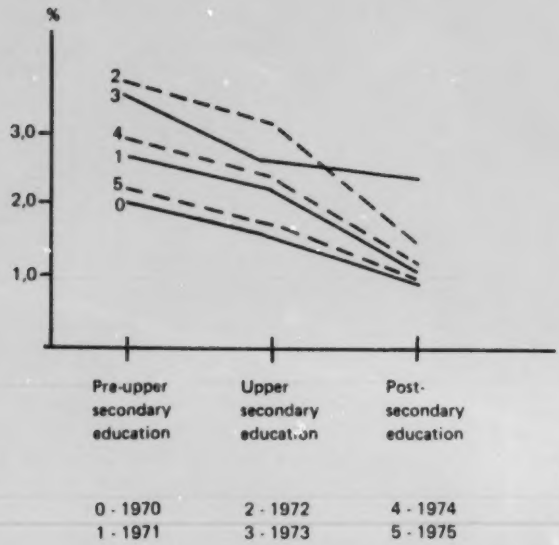
The labour force surveys during the 70s show that the rate of labour force participation varies with education. This is especially true for women. For women with a university education even the characteristic dip in the rate of labour force participation in the ages 25-35 disappears which is not true in for example the U.S.A. The proportion working at least 20 hours a week is also higher for higher educational groups.

Unemployment

During the 70s the rate of unemployment has also been found to vary with education being lower at higher educational levels (graph 12). When business activities go down the rate of unemployment increases in all educational groups but apparently more so for the lower educational groups. These differences in the rate of unemployment among educational groups remained when men and women, different age-groups and regions were studied separately. Among the regions distinguished (woodland, urban and other districts) the woodland districts had the highest unemployment rate but it is interesting to note that the greatest difference among educational groups was found in the urban districts.[71)] As for occupations, the available data (1970, 71 and 72) show that in white collar jobs the rate of unemployment declines somewhat at higher educational levels while this is not true for manual jobs. Above all, the differences in unemployment rate between these two types of jobs are important.[71)] Finally, the duration of unemployment was found to be somewhat longer for lower educational groups in 1970, 71 and 72 but not in 1973 and 74.[71)]

We cannot say whether these differences in rates of unemployment among educational groups were greater or smaller earlier. They might have been more pronounced. The labour market situation of persons just graduating from university can be followed back to 1968 but there are no other educational groups to compare with. Their rate of unemployment increased 1968-72 from 5 to 10%. By 1974 it had again fallen back to 5%. At the same time the percentage share of the graduates who continued studying diminished from 32 to 17% and the proportion working increased from 59 to 73%. Unfortunately these figures do not tell us much about the long run changes of unemployment among highly educated persons neither in absolute terms nor in relation to other educational groups. This information, however, points to another interesting tendency. When the labour market situation deteriorated the propensity to go out looking for job increased. Similar tendencies have been noted for the upper secondary school too.[72)]

Graph 12. Rate of unemployment



Sources: See foot-note 71

For the early 70s we can make some comparisons of unemployment rates among persons leaving the educational system at different educational levels. As the surveys are few in number and not completely comparable we will, however, only note a few tentative conclusions. 1971-73 those entering the labour market having completed comprehensive school seem to have had more difficulties (as judged by the rate of unemployment) than those leaving the upper secondary school. At times during this period, however, the situation for those graduating from universities and specialised university colleges can have been worse than for the two former groups. However, in 1973 and 1974 those leaving the comprehensive school again seem to have been in the worst position.[72]

A special investigation[67] into the unemployment situation in 1975 of young persons with only compulsory, some upper secondary and completed upper secondary education showed that there were some differences between these educational groups. For those with only compulsory education the risk of becoming unemployed was greater and the unemployment periods longer. The problem for them may not so much be to find a job as to find a stable job. The number of only temporary jobs increased over time among those at lower educa-

tional levels. Also, the risk of becoming unemployed increased with longer labour market experience while it decreased for those with upper secondary education.
It looks as if it was more difficult for those at lower educational levels to get a qualifying first job leading to a stable labour market situation. Some may get caught in a vicious circle of temporary jobs and unemployment. For those with upper secondary education the problems encountered on the labour market seem more to have been related to how to find a job in accordance with educational specialisation. It can be added that among groups with different school marks at a given educational level no differences were observed.

The unemployment problem of persons with different educational specialisation can further be illustrated. For the graduates from the different parts of the upper secondary school the recent situation can be summarised in the following way:[73]

1. 3- and 4-year lines. Among boys those with a liberal arts and social sciences orientation have had the highest rate of unemployment while among girls those with a technical, liberal arts and natural sciences orientation have had the highest rate of unemployment. The differences are, however, small.

2. 2-year "theoretical" lines (former specialised professional school). The annual variations are considerable. Among boys those with a technical orientation had the highest rate of unemployment in 1970 and the lowest in 1972. For girls it was the opposite.

3. Lines corresponding to the former vocational school. In 1970/71 the unemployment rate was above the average for those leaving the vocational school with a technical, clerical and service orientation.

Looking at higher education[74] those graduating from the liberal arts and natural sciences faculties have normally had the highest unemployment rates during the early 70s. The relative position of graduates with a social sciences orientation deteriorated during this period. Among the groups surveyed low rates of unemployment were generally found for graduate engineers, Bachelors of law and of economics and business administration, journalists and social workers. Graduates, however, not only work or are unemployed. Some of them continue studying. If we look at the percentage distribution of graduates over these different types of activities[75] the position of graduates from the faculties of liberal arts and natural sciences does not look worse than for many other groups during the period 1967/68-1972/73. The percentage among them being unemployed was neither at the beginning nor at the end of this period higher than the average. It is true that among them a higher percentage continue studying

but this percentage has declined at the same time as the percentage working has increased. Graduates with a social sciences orientation are instead a group with a percentage unemployed among themselves above the average both at the beginning and at the end of the period. However, even for them the percentage that continued studying has decreased and the percentage working increased.

Recalling the development of the educational system the expansion especially at the post-secondary level was heavily inclined towards courses with a liberal arts, social and economics orientation. In spite of this the difficulties encountered while entering the labour market do not seem to have been greater for these groups than for natural scientists. The expansion of technical and natural sciences courses was slow and probably slower than politicians had desired. However, the labour market entry of these groups has not been without problems. At higher educational levels this is especially true for the natural scientists. At the university level the expansion of social sciences graduates, that at least once was regarded as desirable, has brought about a deterioration in labour market prospects for these groups and in certain respects they have had a more difficult time than other groups. Taking these facts into consideration it might be asked whether another composition of the educational output (more technicians and natural scientists) would really have resulted in lower average unemployment rates and if the differences in unemployment rates are such as to warrant a higher degree of steering.

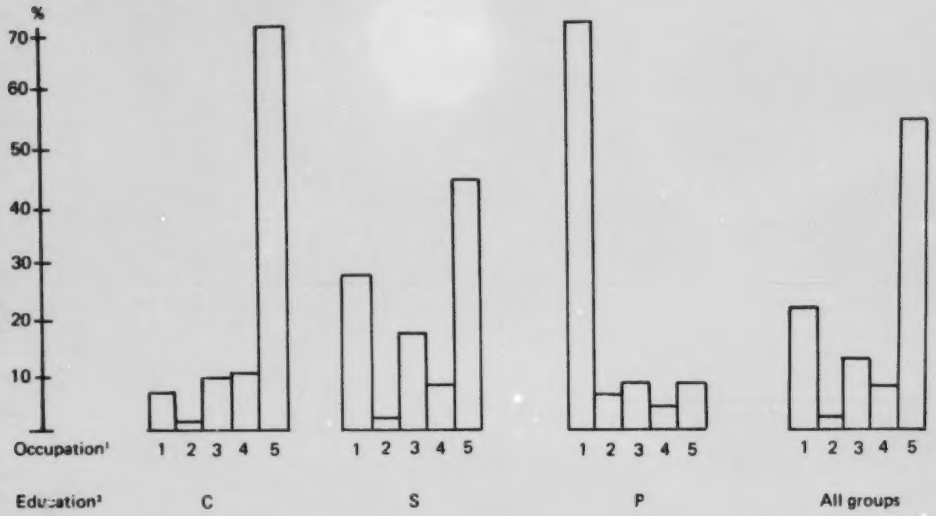
Occupations

The distribution of educational groups over occupations in 1975 is given in graph 13. The graph contains two types of distributions. One, which will be called the occupational profile of an educational group, indicates the percentage distribution of an educational group over occupations. The other is the distribution of employees with a certain occupation over educational levels. In the latter case we will talk about the density of different educational groups within an occupation. These two distributions do not necessarily develop in the same way. In a period of increasing output of for example university graduates their density within certain occupations may increase at the same time as their occupational profile shifts towards other occupations.

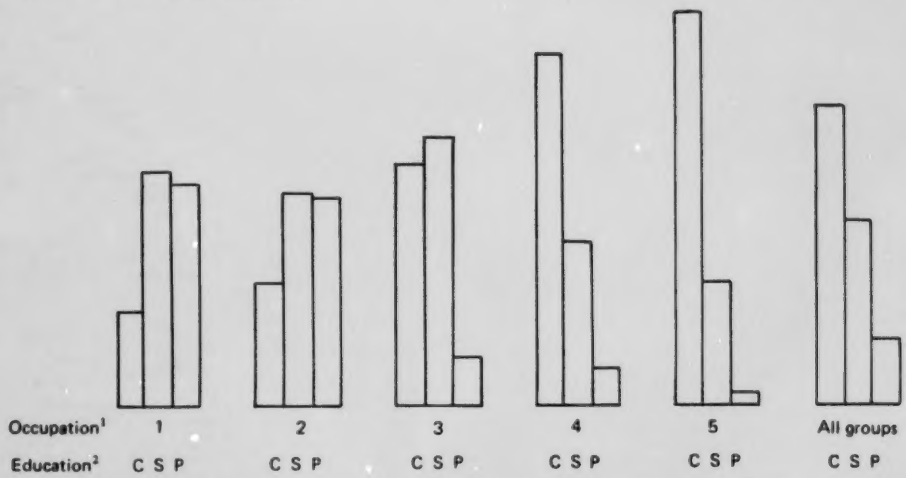
Four groups of white collar occupations are distinguished, professional, technical and related occupations, administrative occupations, clerical occupations and sales occupations, while all the manual occupations form one group. The occupational profiles of the different educational groups are very distinct.

Graph 13. Distribution of educational groups in the labour force over occupations, 1975

Occupational profiles by educational groups



Educational densities by occupations



[1] 1 = professional, technical and related, 2 = administrative, 3 = clerical, 4 = sales, 5 = manual
[2] C = comprehensive (or similar) i.e. pre-upper secondary, S = upper secondary, P = post-secondary

Source: AMS Meddelande från utredningsenheten 1975:24

To approximately the same extent as persons with post--secondary education are found in the first white collar occupational category (74%) the individuals with only comprehensive or similar schooling end in manual occupations (73%). Individuals at the upper secondary educational level are more evenly distributed over occupations.

Looking at the densities the pattern of distribution is not quite the same. Persons with only comprehensive (or similar) schooling predominate in the manual occupations but in none of the white collar occupational groups not even in the first one do persons with post-secondary education form a majority. In occupational groups 1 and 2 which have the highest density of post-secondary educated people (about 40%) there is nevertheless about 40% and 20% of individuals with upper secondary and pre-upper secondary education respectively. The fact that the selectivity to these occupations is not so high can be interpreted both positively and negatively. Positively, to the extent that capable persons lacking formal school merits are not discriminated against and negatively, to the extent that persons with higher education are more productive in these occupations, so much more productive that it would make up for the educational costs. Of course, also the fact that the profiles are so one-sided can be interpreted both positively and negatively from an allocational point of view. Positively, if the educational system adequately fullfills a sorting function and supplies education quantitatively and qualitatively adapted to occupational demand. Negatively, if persons with a certain education costumarily go to certain occupations whether they or their education are suited for them or not.

By comparing the situation in 1975 with that in 1970 we can get a certain idea about the way in which the labour market reacted upon the educational expansion during that period. The changes 1970-75 are rather small. For the occupational profiles we can, however, note that the occupational distribution of the total labour force over occupations shifted from the manual towards the white collar occupations. Within the latter the first, professional, technical and related, and the third, clerical, occupational groups expanded while the administrative and sales occupations decreased in importance. In spite of this the occupational profile of the highest educational group became a little less concentrated to the white collar occupations (92% against 94%) and the percentage share in manual occupations accordingly increased from 6% to 8%. Within the white collar occupations there was a shift of this educational group out of not only administrative and sales occupations but also out of professional, technical and related occupations. The result is that the occupational profile of the highly educated looked less one-sided in 1975 than in 1970. While 85% went to the first two occupational groups in 1970 this figure was 80% in 1975. The group at the upper secondary educational level has also seen its profile shift away from white collar occupations towards manual occupations (45% worked in the latter occupations in 1975 against 41% in 1970). For those at the

lowest educational level the changes of the profile are negligable. It might have been expected that when the highly educated start spreading out over more occupations and perhaps must be content with simpler jobs they would at the same time push out the groups with lower educations from the occupations where the highly educated used to be concentrated. This might have happened to those with upper secondary education as their profile shifted away from the white collar jobs. The chances of ending up in white collar jobs have, however, not declined for the lowest educational group at least not up to 1975.

Considering now changes in density 1970-75 the proportion of the labour force at secondary and post-secondary levels have of course increased. The density of highly educated increased in all occupational groups. In absolute numbers the increase was greatest in occupational group 1, 2 and 3. In manual occupations it only increased from 1 to 2%. In spite of the fact that the share of white collar occupations in the economy as a whole increased and the density of highly educated rose in these occupations their profile shifted away from these occupations. For those at the upper secondary educational level the densities declined in the first two occupational groups and increased in the three others. Especially in manual occupations there was an important increase (from 19 to 27%). The density of people with only comprehensive (or similar) education declined in all occupational groups. While they constituted 25 and 80% of occupational group 1 and 5 in 1970 these figures were 17 and 72% in 1975.

It is difficult to say whether these changes in profiles and density should be given a positive or negative interpretation. The fact that the highly educated seem to end up a little less automatically in the highest groups of white collar occupations could be greeted as a sign of a more efficient and less status-oriented utilisation of this educational category. In such a case the educational system would not be regarded as a sufficient sorting devise. If it were, the development would indicate that the educational output was quantitatively too large which implies unnecessary costs. Moreover, if the educational content at different educational levels is adapted to certain occupations it could mean that an increasing proportion of the labour force gets an education not suited for the occupational tasks. The increased density of highly educated in white collar occupations could in the same way either signify increased discrimination and lower productivity or profitable educational expansion and increased productivity. We will in the last section come back to these problems of interpretation of data that have been hinted at here.

The increased density of highly educated in all occupations, especially in the white collar ones, shows that the inflated number of highly educated could not be absorbed by the economy only through the expansion of the occupational categories to which the highly educated were concentrated. At this

level of aggregation our calculations show that, after having taken into consideration the general expansion of the labour market, changes in the occupational structure (1970-74) was responsible for about 40% of the absorption of the increase in the highly educated. This means that 60% of the absorption was due to increased density of the highly educated within the five occupational groups.

To make a further comparison over a longer period of time we can use the information in the 1960 census about the occupational distribution of graduates from universities and specialised university colleges. They can be compared with those at educational level 7 (post-secondary education more than 2 years) in 1975. These groups are, however, not exactly comparable. The educational definition used in 1975 is somewhat wider and moreover it refers to those in the labour force while in 1960 only those actually employed were included. As for the occupational profile of these "university" graduates the changes 1960-75 are rather small. Approximately the same proportion goes to the first occupational group in 1975 as in 1960 (82 against 81%). The high percentage in 1975 is to a certain extent explained by the fact that more people with teacher training are included in 1975. In 1975 a smaller percentage have administrative work (7 against 13%). The share in clerical occupations (5 against 1%) but even in manual occupations (2 against 1%) has increased. Even though the concentration to the traditional occupations thus still is very high there has been certain changes for those who cannot go to these occupations.[76)]

The development 1960-75 for the "university" graduates resembles that of the whole group with post-secondary education 1970-75 in that those who do not go to the first occupational group more often than earlier end in clerical and manual occupations. The "university" graduates but not the whole group with post-secondary education have managed to keep the same percentage in the first occupational group. Information concerning those who have recently graduated suggests, however, that this type of changes can be expected even for the former.[77)]

The fact that in spite of the expansion of "university" graduates the same high percentage has gone to the first occupational group is combined with a considerably increased density of "university" graduates in this occupational category between 1960-75 (14% against 25%). Even in the administrative occupations the density of university graduates grew rapidly, from 13% to 23%. In the other white collar occupations, clerical and sales occupations, the density of university graduates increased though they are still low in 1975 (3 and 2% respectively). In the manual occupations the density remained below 1% during this period.[76)] These changes in density 1960-75 agree with those earlier noted for the whole group of persons with post-secondary education 1970-75.

This means that during the 60s as well as the early 70s the educational output was much greater than changes in the occupational structure at constant densities would have demanded. Bearing this in mind the absorption process may appear surprisingly smooth as judged by the unemployment rates reported above.

To conclude this section on occupations let us add some information from a few special investigations.

The first concerns the absorption of individuals with higher education in manufacturing, construction and wholesale trade and the possibilities to relate it to the simultaneous increases in productivity.[78] 1959-70 the number of employees with certain types of higher education increased by 100%. Among the four main occupational groups distinguished (technical, commercial, supervisory and administrative-clerical) the expansion of the technical and commercial occupations absorbed 74% of the increase in highly skilled people. Looking closer into the technical occupations it was found that among the subgroups of the technical occupations those associated with increasing the efficiency in the utilisation of existing means of production expanded most. The number working in development work, while remaining at a high level, did not increase very much.

The association between education and productivity would thus in this case go via the control function. Whether this was so and whether there would exist any alternative such as implying more on-the-job-training and more of a workers' control of the working process can not be evaluated from this study.

Recently a number of reports,[79] causing alarm and surprise, have shown that rather few people end up in occupations that could be more or less closely associated with the students' field of study: about 20% for certain types of labour market training courses and 43% for certain vocational courses at the universities. However, among the first degree university graduates about 70% reported that three years after graduating they held relatively qualifying jobs within a field approximately corresponding to their educational specialisation. The figures varied between 50-90% for different types of education.

Finally some findings can be reported from a retrospective longitudinal study of people in leading positions in private firms and the consumers' co-operative association.[80] The career development in the co-operative sector was quite different from that in the private sector. Those in the co-operative sector followed more of a deliberately planned promotional sequence starting at rather low levels, the co-operative association itself supplying necessary educational courses. Among those working for private firms the starting level seems to have been fairly closely related to educational level and the starting type of job to educational orientation.

Those with a lower educational level also more often started in smaller firms. With the promotion from one occupational level to another changes of firm seem to have diminished but changes of type of job seem to have been augmented.

Branches

The distribution of educational groups over branches of economic activity in 1975 is given in graph 14. The same two types of distributions as for occupations are shown. Four groups of branches are distinguished. All goods producing branches form one group (1). As for the rest of the economy (i.e. the service sector) the commerce and transport branches (2), the banking, insurance, real estate and commissonary branches (3) and the public administration and other branches (4) are reported separately.

The branch profiles of the three educational groups are very different. Among those with comprehensive, or similar, education 51% go to the goods producing branches and 21% to public administration and other services branches. The corresponding figures for those at the post-secondary educational level are 14% and 68%.

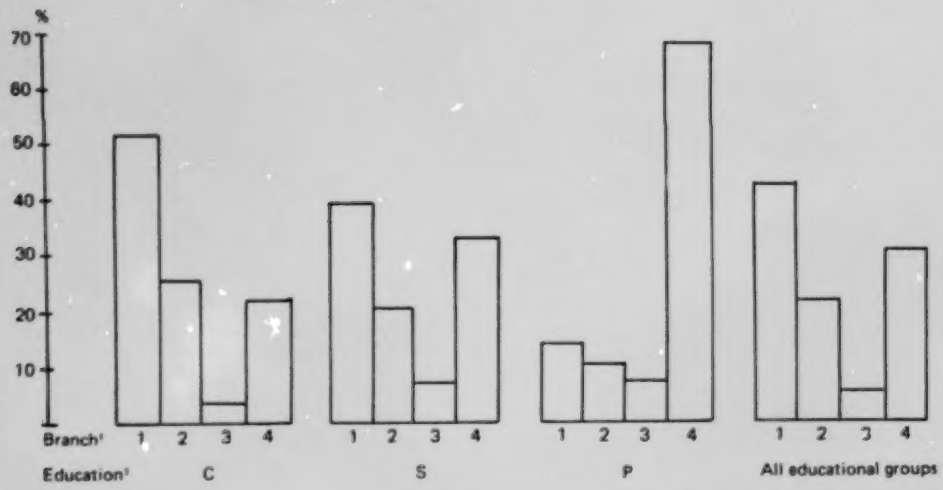
As for densities the group with comprehensive schooling dominates not only the goods producing branches (65%) but also the commerce and transport branches (62%). The density of highly educated is 19 and 26% in branch group 3 and 4 of the service sector.

Compared with 1974 the branch profile of the total labour force has remained about the same. This is also true for the branch profile of the lowest educational group. For those at the secondary and post-secondary educational levels there have been compensating reshufflings. Those with secondary education went a little more often to the goods producing branches in 1975 than in 1974 and those with post-secondary education a little less often in 1975 than in 1974.[76]

Between 1974 and 1975 the density of the highly educated increased in the total economy. As the structure of employment by branches did not change increased densities of highly educated within branches occurred. Increased densities of highly educated was brought about in all 3 branch groups of the service sector especially in group 3 and 4. The density of highly educated did, however, not increase in the goods producing branches. The proportion of individuals with upper secondary education also increased in the total labour force but this only led to increased densities in the goods producing branches and in the commerce and transport branches. The density of the lowest educational group declined in all branch groups.

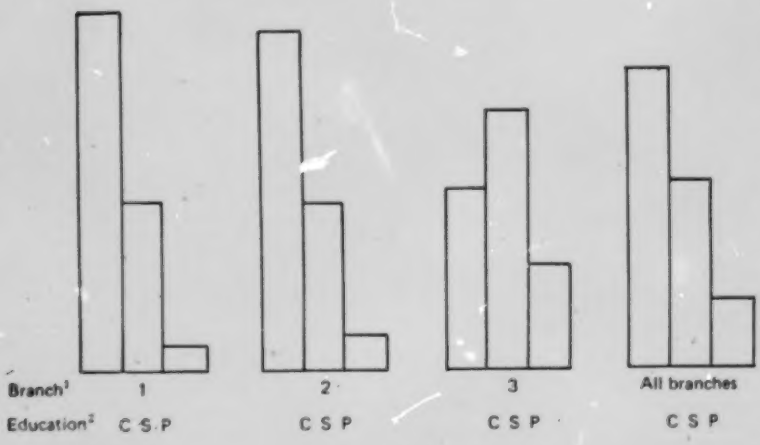
Graph 14. Distribution of educational groups in the labour force over branches of economic activity, 1975

Branch profiles by educational groups



Graph 14. (page 2)

Educational densities by branches



[1] 1 = goods producing branches, 2 = commerce, restaurants, hotels, transport and communication, 3 = banking, insurance, real estate and commissionary activities, 4 = public administration and other services

[2] C = comprehensive (or similar) i.e. pre-upper secondary, S = upper secondary, P = post-secondary

Source: AMS Meddelande från utredningsenheten 1975:25

To get more of a historical perspective on changes in the distribution of educational groups over branches we can report some results from an investigation of higher education and changes in branch structure between 1960-70.[78] For the graduates from universities and specialised university colleges the branch profile has shifted in the direction of the service sector away from the goods producing branches during this period. Whereas the former employed 79% of the university graduates in 1960 the percentage share had increased to 84% by 1970. The service sector received as much as 94% of the increase in graduates. The public sector which mainly belongs to the service sector traditionally employs a great number of graduates. The proportion of them working for the public sector has also increased (from 55% to 59% during the period studied). Among the goods producing branches the graduates are concentrated in the manufacturing industries (13% in 1970). The manufacturing industry was the only goods producing branch that took care of more than a negligable amount of the increased number of graduates.

The density of university graduates increased in most branches but rather slowly. Making the same type of calculations as for occupations but based on 15 branches it turns out that increased density of university graduates within branches can only "explain" 30% of the absorption of the increased supply of graduates. The rest, 70%, is related to the change in the structure of branches of economic activity. This means broadly speaking that the expansion of the branches making up the service sector could at given densities absorb most of the expansion of the university educatec Thus the educational expansion seems to have resulted in little disruption of the traditional density pattern within branches and more disruption within occupations.

Concerning the density of graduates from universities and specialised university colleges in manufacturing industry we can add a few figures from an earlier period. It has been estimated[81] that in 1930 it was 0.5% and in 1960 1% to be compared with 1.3% in 1970.[78] This density has thus not increased very rapidly. In connection with the survey of changes in the density of university graduates within manufacturing industries 1930-60[81] the development in different types of industries was related to various explanatory factors. A positive correlation was found between this density and productivity, capital intensity and different measures of the composition of the personnel (percentage of employees with higher education other than university education, the relative size of the administrative staff and the relative number of managers and technicians). The relative size of the administrative staff was positively correlated with the size of firms which indirectly links the density of university graduates to the size of firms.

Regions

The regional distribution of educational groups in the labour

force in 1975 is indicated in table 2. The regions distinguished are: big town counties, woodland counties and other counties. This classification is of course very crude. The regional profile of the highly educated is, however, more concentrated to the big town counties than that of lower educational groups. Among those with post-secondary education 54% work in big town counties while the corresponding share of the lowest educational group is only 33%.

As for densities, the lowest educational group makes up 47% of the labour force in the big town counties and 57 and 60% of the labour force in woodland and other counties respectively.

During the period 1970-75 the distribution of the labour force over these three types of regions has hardly changed at all.[71] This means that changes in the regional profile of one educational group must be compensated by changes in the profiles of other educational groups. In this case as well as for changes in occupational and branch profiles we find that the profile of the lowest educational group has not changed. In the other two profiles, however, there have been compensating shifts. The regional profile of the highly educated has shifted towards big town counties and that of people with upper secondary education out of big town counties.

Table 2. Regional percentage distribution of different educational groups in the labour force 1975

Region \ Educational group	Pre-upper secondary	Upper secondary	Post secondary	Unknown	Total
Big town counties	47 33	35 41	17 54	1 59	100 38
Woodland counties	57 21	34 20	8 14	1 14	100 20
Other counties	60 46	31 39	9 32	0 27	100 42
Total	54 100	33 100	12 100	1 100	100 100

Source: AMS Meddelande från utredningsenheten 1975:24

The fact that the regional distribution of the labour force has not changed at the same time as the percentage of highly educated in the labour force has increased further means that the density of highly educated must have increased within regions. As a matter of fact it increased in all types of regions but

least so, both in absolute and relative terms, in woodland counties (from 7% to 8%).

Mobility

The mobility on the labour market of different educational groups has not been subject to very close comparative analyses. A few results from two surveys can, however, be reported. The first is a longitudinal study of a sample of men completing compulsory education in 1942-43 and followed up to 1956.[82] The differences among educational groups related to geographical mobility and rural-urban migration was investigated. It turned out that in general the migrating groups had more education than the non-migrating groups. This was especially true for geographical movements over longer distances and migration out of rural districts.

The second survey,[83] concerned with the gross inflow to the labour market in 1966-67, showed that in connection with the entry into the labour market 20% of those becoming economically active changed residency. Among the university graduates 43% moved geographically as they entered the labour market. This can be compared with 11% for the lowest educational group. Disregarding short distance movements (less than 50 km) the differences are even greater, 43% against 5%, for the educational groups mentioned above.

To this can be added some information about the propensity to change employment and type of work among certain types of university graduates even though there are no comparable data for other educational groups.[84] A follow-up study of certain groups graduating from universities and specialised university colleges in 1967 showed that after 2 years 10-50% had changed employment. The figure varies somewhat according to type of degree being highest for Masters and Bachelors of Arts from the faculty of liberal arts and Bachelors of Arts from the faculties of natural sciences and law and lowest for graduate engineers. At the same time 5-20% changed type of work. This happened most often for social scientists and Bachelors of economics and business administration and least often for Masters of Arts from the faculty of liberal arts.

Among the groups of graduates from universities and specialised university colleges surveyed in 1971/72 and 1972/73 and who worked at the time of graduation only 60% of the men and 70% of the women had the same employment six months later.

We cannot get a very precise picture of the mobility of different educational groups from these data but it is possible that higher education leads to greater possibilities to change residency, employment and type of work as well as a higher propensity to take advantage of these possibilities.

International comparisons

Let us now finally make a few international comparisons of unemployment rates, occupational and branch distribution of different educational groups:

1. Unemployment rates. A negative correlation between educational level and unemployment rates is no unique feature for Sweden. In the U.S.A, for example, the situation has been the same. There too, the unemployment rates of the higher educational groups have usually been less sensitive to fluctuations in the level of business activity.[85] During the early 70s, however, the labour market situation of the highly educated has deteriorated in the U.S.A. The rate of unemployment among college educated and recent graduates from college has increased both in absolute terms and in relation to other educational groups. At times it has been higher for recent graduates from college than for their counterparts at lower educational levels.[86]

2. Occupational distribution. The OECD compiled data about the educational structure of the labour force and its distribution over occupations and branches in a great number of countries around 1960. Some of these data will be found in table 3, which shows the occupational distribution of university graduates in the labour force. In 1960 the share of university graduates in the labour force was very low in Sweden, only 2%. In many countries including Canada, France, Greece, Japan, Norway, the U.K. and the U.S.A. it was higher. Low rates are noted for the Netherlands and Portugal.

The occupational profile of university graduates is much more concentrated to the first occupational group (professional, technical and related occupations) in Sweden than in other countries. Countries with higher as well as lower density of university graduates in the economy as a whole have a lower percentage of the university graduates in this occupational group. The 81% for Sweden should be compared with the 60% for the U.S.A. To this corresponds the fact that in Sweden the share of the university graduates that go to clerical, sales and other occupations is very low (6% in Sweden, 27% in the U.S.A.). Even if the proportion of graduates in the first occupational group has recently declined it is without doubt still much higher than the figure of the U.S.A. for 1960. The link between education and occupation thus seems to be stronger in Sweden than in other countries, a fact that may cause trouble adapting to a higher average level of education in the labour force and achieving an efficient utilisation of such labour.

If we now look at the density of university graduates within occupations it can be noted that in countries with a high general density of university graduates the density in the first occupational group is often also high. The density of university graduates is for example very low in Sweden both in the first and second occupational group (14% and 13% respectively) compared with the U.S.A. (53% and 18%) but these densities are still

Table 3. Density of university graduates in certain occupations and occupational profile of university graduates around 1960

	Occupational profile					Density		
	Professional, technical and related occupations	Administrative, executive and managerial occupations	Clerical and sales occupations	Other occupations	Total	Total economy	in professional, technical and related occupations	in administrative, executive and managerial occupations
Canada	70	12	10	8	100	4.3	31	10
France	67	14	10	9	100	2.7	18	20
Greece	69	7	10	14	100	2.9	57	27
Japan	36	12	41	11	100	3.5	26	18
Netherlands	77	15	6	2	100	1.4	12	6
Norway	73	17	3	7	100	2.6	24	14
Portugal	76	6	6	12	100	1.2	33	6
Sweden	81	13	4	2	100	2.1	14	13
United Kingdom	73	6	9	12	100	3.2	27	8
United States	60	13	15	12	100	9.1	53	18
Yugoslavia	78	13	5	4	100	3.3	20	18

Source: OECD: Deployment and Utilisation of Highly Qualified Personnel: Statistical Annex DAS/EID/66.2 as quoted by M J Bowman and C A Anderson in Mass Higher Education: some perspectives from experience in the United States. OECD 1973

lower in the Netherlands with even fewer university graduates in the labour force. Thus even though in Sweden the university graduates are very concentrated to the first occupational group they have to a lesser extent prevented other educational groups from entering these occupations than in other countries.

Earlier we noted that as the average density of the highly educated increased the density in especially the white collar occupations grew. However, still in 1975 it seems to be lower than in the U.S.A. in 1960.

Of course these differences among countries are not only coupled to differences in the supply of graduates but also to differences in the occupational structure. An analysis made by the OECD secretariate showed that the factors that could best "explain" differences in occupational structure was output per worker and product per capita.[87] Thus, Sweden had an occupational structure more ressembling that of the U.S.A. than that of Portugal. She also had an output/worker ratio closer to that of the U.S.A. than that of Portugal.[88] However, the supply of highly educated labour was closer to that of Portugal. To put it bluntly: in Sweden there are many white collar jobs and few highly educated. This makes for a low density of highly educated in these jobs as well as in the economy as a whole at the same time as almost all university graduates work in white collar occupations.

The analyses of the OECD secretariate further showed that a certain economic level could be attained in many different

ways. Apparently there exist great substitution possibilities among occupations and educational groups at least at the levels of aggregation used here. It is difficult in any absolute sense to talk about the need of the economy and of these occupations for labour with certain qualifications. Within an occupation the actual educational composition of those employed seems to be as much determined by the supply of labour with different qualifications as the "need" for certain qualifications to exercise a given occupation.[89]

The data material used above illustrated the situation around 1960. We can add a few words about the development in the U.S.A. since that time. The occupational group "professional and managerial", that earlier was very expansive has stagnated and does not employ a greater share of the labour force in 1974 than it did in 1969. At the same time the supply of graduates from college has continued to increase. The percentage of the graduates from college that have been able to enter this kind of occupations has therefore been strongly reduced. It has been estimated to have decreased by 20% during the period 1958-70. Among young college graduates a much greater proportion will be found in sales and clerical occupations than before.[86] During the 70s this change in occupational profile for the college graduates has been accompanied by increased unemployment and, as we shall see later, lower earnings. Already in 1960 did the highly educated have quite another occupational profile in the U.S.A. than in Sweden. However, only the further development in that direction during the 70s brought about a deterioration in their labour market position in relation to other educational groups in terms of earnings and unemployment.

3. Branch distribution. The density of university graduates within certain branches of economic activity is indicated in table 4. Once again the situation described is that of 1960 as recorded by the OECD.

In the manufacturing industries as well as in the commerce and transport sectors the percentage of university graduates is rather low in Sweden. In the manufacturing industries they only make up 0.9% of the labour force to be compared with 5.9% in the U.S.A. and 3.8% in Japan.

The Swedish service sector is a little bit better provided with university graduates. The density is 7%. Even this figure is, however, below that of the U.S.A. (19%) and Japan (10%).

The econometric analysis of these data on education and branches of economic activity made by the OECD secretariate showed that in this case as well as for occupations large possibilities of substitution exist. A certain economic level or a certain growth of the economy does not presuppose any

Table 4. Percentage of those employd within designated sectors with a university degree

Country	Branch			
	M	C	T	S
Belgium	0.99	2.35	0.05	6.29
United States	5.94	6.84	0.19	18.57
Japan	3.75	4.46	0.17	9.68
Norway	1.23	1.81	0.07	9.42
Netherlands	0.57	0.70	0.03	4.27
Sweden	0.89	1.24	0.03	7.17
Yugoslavia	1.02	1.29	0.02	9.44
Argentina	0.90	1.50	0.03	6.41
Egypt	0.84	1.51	0.07	7.12
Hungary	2.03	3.22	0.08	16.16
Israel	2.15	3.40	0.11	9.05
Pakistan	0.28	0.65	0.01	3.14
Panama	1.09	2.95	0.04	4.76
Philippines	2.10	5.80	0.10	18.64
Poland	1.97		0.05	15.83
Syria	0.20	0.85	0.02	4.68
Uruguay	0.76	1.36	0.02	4.41
Zambia	0.48	0.96		3.00

M - manufacturing
C - commerce
T - transport
S - service

Source: OECD Occupational and educational structures of the labour force and levels of economic development. Further analyses and data. Paris 1971 pp 124–127

precise branch structure or educational composition of the labour force within economic branches. The educational composition of the labour force within sectors is not only related to demand for but also to the supply of labour with different types of education.[89)]

3.3 Some macroeconomic data

As education has often been conceived of as a major factor promoting economic growth some data relevant for such a discussion at an aggregate level have been put together in this section.

The growth rate of the Gross National Product (GNP) has fluctuated between 1861 and 1972 without revealing any trend. It is true that during the 50s and 60s it accelerated but during the period 1965-72 the growth rate fell back into line with earlier experiences.[90]

During this period the labour force has also grown but the growth rate of the labour force has been lower than that of the GNP especially during the 50s and 60s and measuring labour by working hours.[90] It is quite possible that without the educational expansion the number of persons economically active would have been still lower. As we noted in the preceding section labour force participation and educational level have been found to be positively correlated. However, as we have no figures for the educational composition of the labour force and rates of labour force participation within educational groups over longer periods of time we cannot even try to estimate to what extent the educational expansion can be said to have contributed to the growth of the labour force and thus to economic growth.

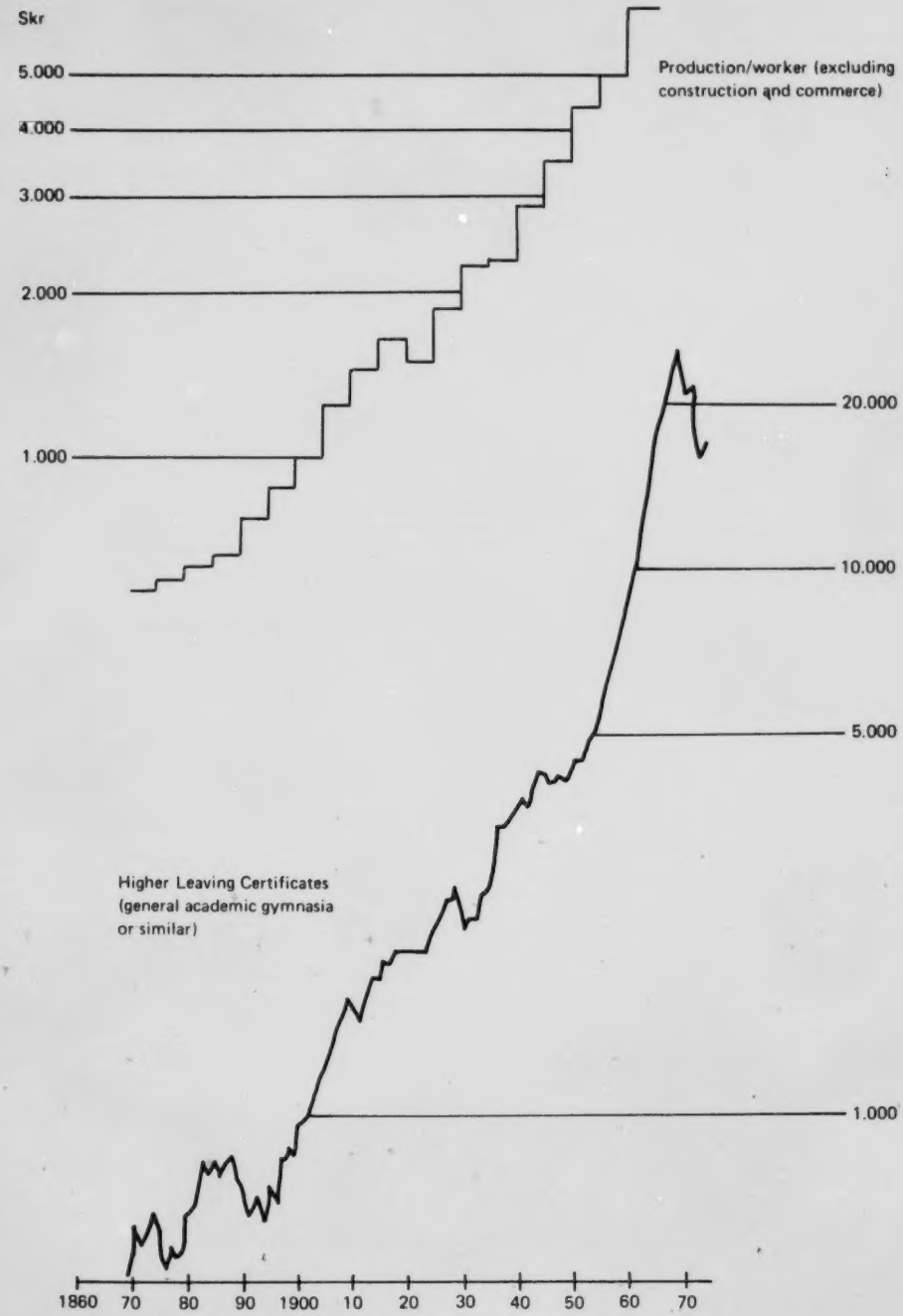
Another question that might be raised is whether the increased labour productivity could be related to the educational expansion. In graph 15 we let the number of Higher Leaving Certificates awarded by general academic gymnasia, or similar, represent the educational expansion and recent stagnation. Between 1870 and 1900 the number of certificates increased by jerks. The level in 1900 as compared with that in 1870 implies an annual compound rate of growth of 2.3%. Up to 1920 the expansion was smoother and faster, corresponding to an annual growth rate of 3%. The 20s and the beginning of the 30s were characterised by stagnation. During the period 1930-48 the annual growth rate was once more around 3%. During the late 40s there was again a certain stagnation while the period 1948-68 showed an unprecedented growth rate of 9.5% per year. The decrease in 1968-73 was 7% annually.

The top of graph 15 shows the corresponding development of production per worker. The same kind of pattern is visible: at first a rather low growth rate (1870-90), then a somewhat more rapid growth (1890-1920), stagnation, growth at about the same rate as before the stagnation (1920-40), stagnation and finally a much more rapid rate of growth. For the recent decades we can add an estimation of the development of production per working-hour:[91]

	Annual rate of growth
1950-60	3.3
1960-65	5.6
1965-70	4.7
1970-72	4.0

As can be seen the rate of growth has not continued to in-

Graph 15. Production per worker (price level of 1913) and number of Higher Leaving Certificates awarded by general academic gymnasia (or similar)



Source: A Sohlman: Utbildning och arbetsmarknad. Working paper No 1976:1 Department of Economics, University of Stockholm p 134

crease. However, it never was negative like that of educational expansion.

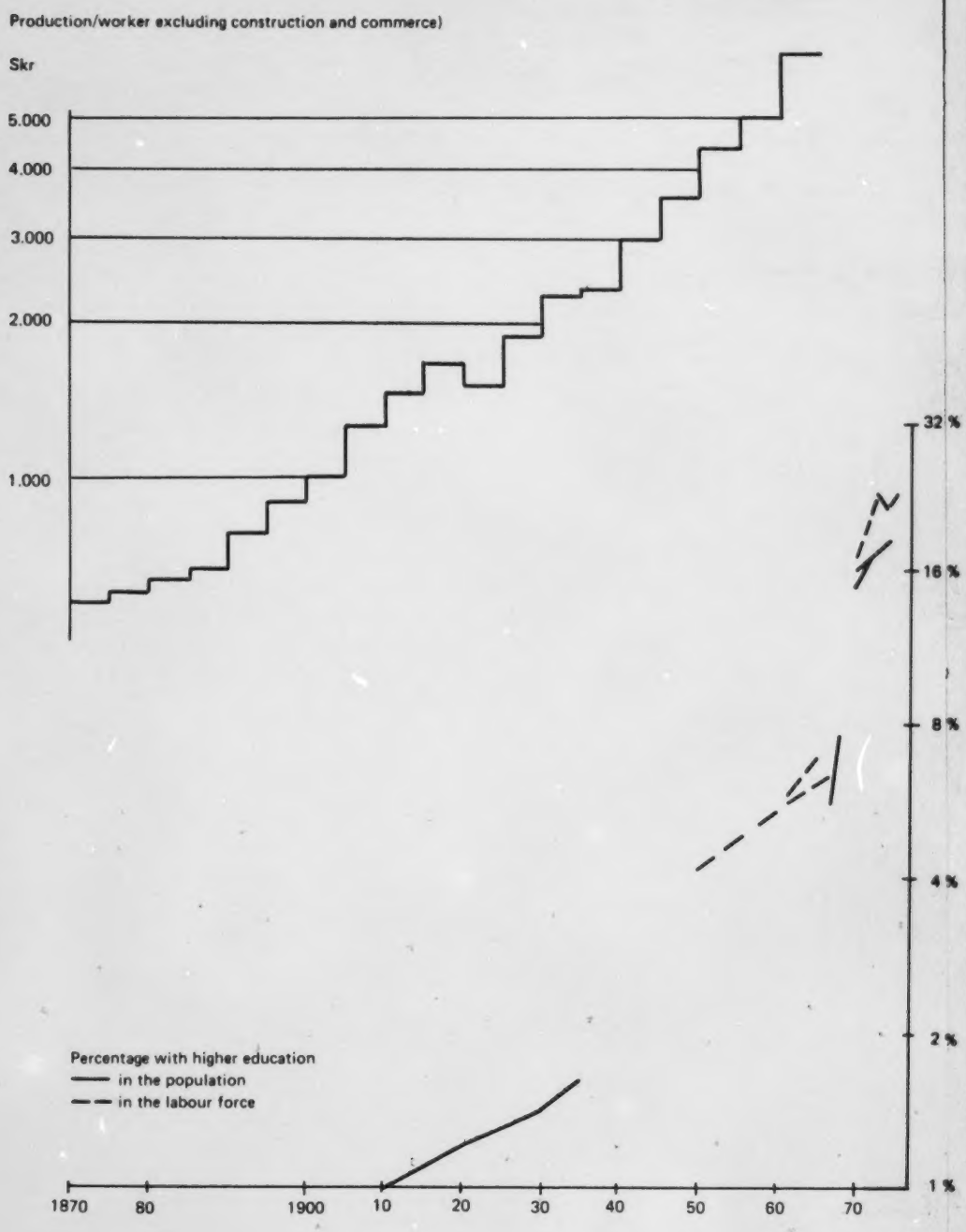
Hardly anyone has argued that increased education affects the productivity but with a certain lag. According to graph 15, however, educational expansion seems to parallel that of productivity or rather lag somewhat behind. A possible conclusion of this would be that rather than becoming "rich" from more education the Swedes have had more education because they have become "richer". Be that as it may, graph 15 at least makes clear that from this type of data we cannot directly conclude that more education results in higher productivity.

If education makes people more productive as they join the labour market comparing the development of the education of the labour force and that of productivity may appear a more appropriate strategy if you are interested in the consequences of educational expansion for economic growth. Actually we have too little information of a comparable kind about the education of the labour force in Sweden to really make such a comparison. In graph 16 we have, however, put together data about the development of productivity and the available information from various sources about higher education in the labour force and in the population. The graph seems at least to support the conclusion that productivity and the amount of higher education in the labour force are positively correlated.

Probably these attempts at finding direct traces of educational expansion in the GNP-development appear rather naive when at the same time so many other important events have taken place: the industrialisation of Sweden, the enormous capital accumulation accompaning the industrialisation, the First World War, the Great Depression, the Second World War etc. In many countries more detailed analyses of the GNP-growth have related the economic growth to different growth promoting factors including education. We cannot report on any such analysis explicitely considering education for Sweden. A less ambitious attempt has, however, been made to relate the growth of GNP to the growth of the labour force and of physical capital by means of a production function analysis. The part of the economic growth that cannot be "explained" by increases in labour force and physical capital the so called residual is of some interest to us here as it can be said to cover the effects of all other growth promoting factors including education. The result for Sweden looks as follows:[92]

	Annual percentage growth rate of production	Contribution from various factors to the annual growth rate of production:		
		physical capital	labour force	residual
1870-1913	2.81	1.35	0.28	1.18
1920-1939	2.48	0.98	0.54	0.96
1946-1964	3.44	0.85	0.43	2.04

Graph 16. Production per worker (price level of 1913) and percentage share of the population or labour force with higher education



Source: A Sohlman op cit p 140

This means that the residual is responsible for 42, 39 and 59% of the economic growth during the respective subperiods. The effects of what factors the residual actually covers and how much of it could be attributed to education we do not have any information about from these figures. The data do not contradict the hypothesis that the increase in the residual during the last sub-period is due to the educational expansion and that without more education the growth rate would have been lower.

A few international comparisons can also be made with respect to education and economic development. Many studies of the development over time in one country or comparing different countries at a given point in time have shown as we earlier noted for Sweden that there exists a correlation between the volume of educational activities (either measured in financial or quantitative terms) and GNP or GNP per capita.[93] Rich countries devote more resources to education than poor countries. Normally a certain variation between countries is, however, found. A survey of the situation in different countries around 1958 conducted by the OECD indicated that, for example, the Soviet Union and even Sweden at least for higher educational levels devoted more resources to education than other countries at a similar economic level.[93] Estimating the connection between education and GNP in terms of the income elasticity (percentage change in educational activities/percentage change in GNP) one arrives at somewhat different results in longitudinal and cross-section studies. In the latter the elasticity has been around 1 while it has been found to be higher within countries over time.[93]

With a few exceptions[94] this kind of results have been interpreted as indicating the existence of a causal relationship the direction of which goes from GNP to education not the other way round.[93] There may exist an influence in the other direction (from education to GNP) but this is better shown by other means.[95] As an example of studies which have been thought to indicate the existence of a causal relationship in the other direction we can mention:[95]

- studies indicating that a certain level of literacy and primary education is a necessary precondition for economic development
- studies indicating that among countries at the same level of economic development those with more educational activities will have a faster economic growth than those with less[x]
- studies indicating a positive correlation between GNP-level and higher education in the labour force.

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x) It should, however, be mentioned that a positive correlation between different measures of educational volume (or changes in educational volume) and later GNP-level (or changes in level of GNP) has not always been found.

The most influential support for the assumption that education causes economic growth has probably been that given by production function analyses which explicitely treated the educational factor. They began to be made in the U.S.A. in the 60s. This approach has, however, later been heavily criticised both for practical and theoretical reasons[96] and authors have also come to rather divergent results. In one study it was found that for the U.S.A. during the period 1929-57 education could "explain" 23% of the economic growth (this being a lower limit as there was also a factor "advancement of knowledge" that "explained" 20% of the growth). In a somewhat later investigation the contribution of education to economic growth in the U.S.A. 1945-65 was estimated at only 14%.[96]

For certain European countries low figures were also arrived at (Belgium 14%, Denmark 4%, France 6%, Italy 7%, the Netherlands 5%, Norway 7%, West-Germany 2% and the United Kingdom 12%) during the period 1950-62.[97] If these figures are accepted not much of the economic expansion after the Second World War of at least these European countries would be related to the educational expansion. In the late 60s these countries (with the exception of Italy) have experienced a fall in the growth rate while the educational expansion has continued.[98]

Altogether this gives rather frail support for the assumption that education is a direct and uncomplicated cause of economic growth.

4 Education and distribution

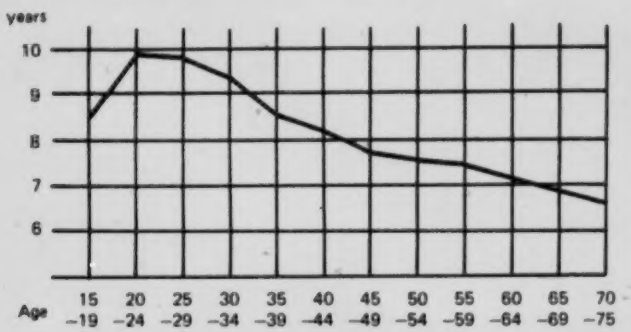
This section is concerned with the educational system as a distributional devise. First we will describe how the educational resources have been distributed both between and within generations and between individuals of different social origins. In the second part, distributional effects due to the connection between education and earnings will be considered.

4.1 The distribution of educational resources

Comparing generations

The education received by different generations is indicated in graph 17. The data come from a cross-sectional study in 1967 and shows the average number of years of education different age-groups have received up to 1967. That there are considerable differences among generations is hardly surprising. The fact that the educational expansion entered an accelerated phase rather late, however, means that there are great differences not only between the young and the old but also between the young and the middle-aged. As for the youngest generations it must be added that an important number are still studying (e.g. 13% of the 25-29 age group).[1)]

Graph 17. Average years of education by age-groups in 1967



Source: Låginkomstutredningen. L Johansson: Utbildning – empirisk del Sthlm 1971 p 32

An educational policy aiming at eliminating these differences would devour enormous amounts of resources. "If all those approximately 3.2 millions aged 20-64 with only primary education should be given 4-5 years more of education and the approximately 1.1 millions with only lower secondary

education 2 more years of education 'society would have to provide for 17 million years of full-time education'. This would, for example, imply that 10% of those aged 20-64 would have to be engaged in full-time education for over 30 years".[2] Earlier was mentioned a rough estimate of 150.000 adults in full-time education. This figure included on-the-job training but let us assume that adult education at relevant levels was expanded to 150.000 full-time adult students. To obtain 17 million years at a pace of 150.000 per year takes about 110 years. This would be too slow to achieve the above mentioned reduction in differences between generations while they were still alive. Of course, if the average level of education of younger generations is not further increased the intergenerational differences will eventually disappear. However, the 20-year old persons of to-day will be 70 only in 50 years.

Differences within generations

Discussing the educational composition of the population it was mentioned that the younger generations were more evenly distributed over educational levels than the older ones. Thus in this respect the differences within generations have been reduced. Measuring the education received by numbers of years we can calculate the differences within generations both in absolute and relative terms. The standard deviation measures the spread around the average in absolute terms.

Table 5 shows that the standard deviation increases somewhat from generation to generation. Moreover, the figure for those aged 25-29 and even 30-34 could not be regarded as definite as 13% and 5% among them are still studying.[1] The spread in years of education in relation to the increasing average as measured by the coefficient of variation also tends to increase from generation to generation at first but later this coefficient decreases.

Table 5. Variation in years of education by age-groups in 1967

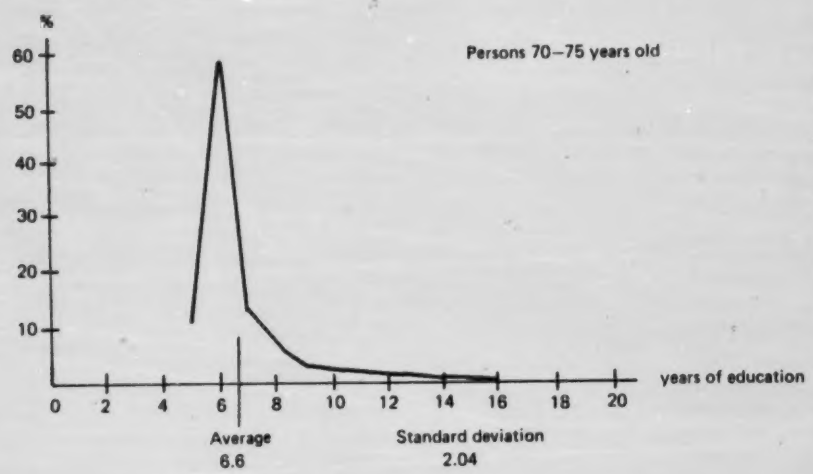
Age	25-29	30-34	35-39	40-44	45-49
Standard deviation	3.09	3.06	2.98	3.05	2.90
Coefficient of variation	3.15	3.29	3.46	3.71	3.76

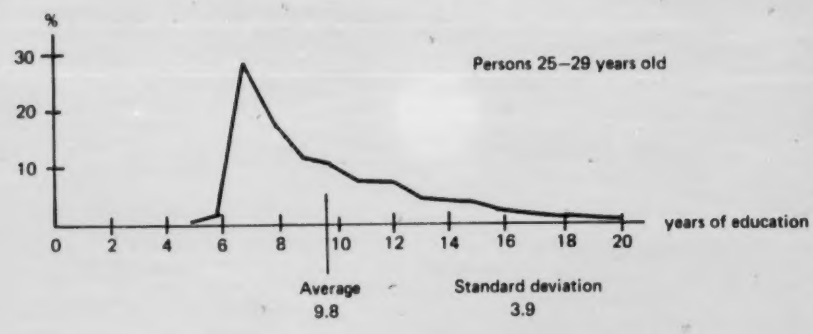
Age	50-54	55-59	60-64	65-69	70-75
Standard deviation	2.50	2.38	2.34	2.27	2.04
Coefficient of variation	3.28	3.17	3.25	3.28	3.09

Source: L Johansson op cit pp 35, 162

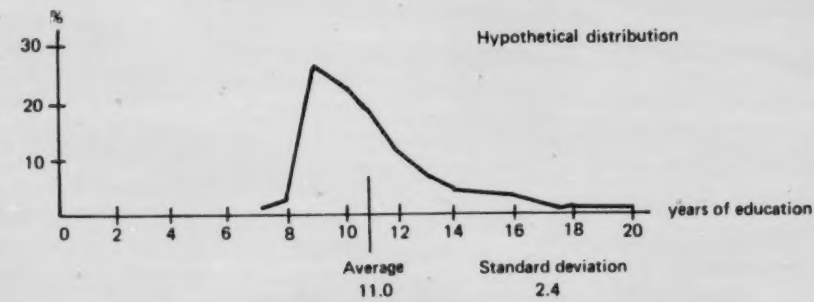
Metaphorically the distribution for a generation over years of education can be seen as a caterpillar on a string (graph 18). It advances by streching forward and as a result the average and the spread increase. Thereafter, the behind is pulled up which also increases the average but reduces the spread. The development so far seems to have been mostly characterised

Graph 18. Distribution over years of education for different generations in 1967 and a hypothetical distribution





Source: L. Johansson op cit p 162



Source: see the text

by the first part of this movement. It is possible that for future generations the distribution will be more compactly situated around the mean. It must be remembered that among those aged 25-29 in 1967 as many as 47% had less than 9 years of education.[3] If, in future generations, practically no one has less than 9 years and the expansion of higher education is damped a reduction in the spread around the mean may be expected. The hypothetical distribution at the bottom of graph 18 has been constructed assuming that practically every one gets 9 years of education, 70% continue after 9 years and 20% after 12 years. The latter figure implies an increase by only one percentage point compared with those aged 25-29 in 1967. For this distribution the average is 11.0 years and the standard deviation has been reduced to 2.4 years.

Social differences

To describe the distribution of education between individuals of different social origins let us first use data from the 1967 cross-sectional study. The individuals were grouped into three categories according to the occupation of their father. In brief, social group III consists of those whose fathers were manual workers, social group II of those whose fathers ran small enterprises or had subordinate non-manual jobs and social group I of those whose fathers held leading business positions or non-manual jobs at higher hierarchical levels.[4] This means that comparing the different generations the distribution of individuals over classes of social origin does not remain the same. Among those aged 15-29 e.g. 9% belong to social group I and 54% to social group III as compared with 4% and 62% among those aged 55-75.[5]

In 1967 the average length of education was 12, 9 and 8 years among all individuals irrespective of age belonging to social group I, II and III respectively.[6]

Let us now compare the different generations. According to table 6 the absolute difference in average years of education between social group I and III was about the same for those aged 55-75 and 25-29 in 1967 (5.6 and 5.4 years respectively). As the share among those aged 25-29, belonging to social group I and still studying, is three times as high as among those belonging to social group III it may be concluded that at least up to those aged 25 in 1967 the absolute differences have not decreased. Considering the great social difference in percentages still studying among those aged 20-24 it can be doubted whether any reduction in social differences will result even for them.

As for relative differences table 6 shows that the average education was 80% higher for those aged 55-75 in social group I when compared with similar individuals in social group III. For those aged 25-29 it was only 60% higher. The final result when they get older will certainly be a greater relative difference

but possibly lower than for the oldest generation. It takes much more extra education among those still studying to increase the average so that the relative differences remain the same as earlier than to increase it so that the absolute differences remain as before.

Table 6. Average years of education, percentage still studying, percentage with 9 and 12 years of education and with Higher Leaving Certificate in different age-groups by social origin

Social group	Average years of education					9 years of education (%)		12 years of education (%)		Higher Leaving Certificate (%)	
	Age 20-24	% stud	Age 25-29	% stud	Age 55-75	Age 15-29	Age 55-75	Age 20-29	Age 55-75	Age 20-29	Age 55-75
I	11.9	75	14.4	35	12.2	97	84	67	54	45	31
II	10.3	30	10.0	13	7.4	75	19	29	9	12	3
III	9.3	19	9.0	10	6.6	62	7	15	2	7	1
I-III	2.6		5.4		5.6	35	77	52	52	38	30
I/III	1.3		1.6		1.8	1.6	12.0	4.5	27.0	9.0	31.0

Source: L Johansson op cit pp 88–92

Thus, while the relative social differences in average education may be decreasing the absolute differences seem to have remained about the same. Similar comparisons between generations can be made for different educational levels. Table 6 indicates that comparing the percentage share:

- obtaining at least 9 years of education in social group I and III both the absolute and relative differences have been reduced. (The figures are based on the assumption that all those still studying will receive at least 9 years of education)
- obtaining at least 12 years of education in social group I and III there has been a reduction in relative differences while absolute differences have remained the same
- passing the Higher Leaving Certificate in social group I and III, the relative differences have decreased while the absolute differences have increased.

Many investigations have been designed to especially study the social composition of the student body at the universities. The problem is that often they are not comparable and moreover build on approximations. Let us, however, look at table 7 where we have certain figures approximately describing the situation in the early 50s and late 60s and in 1968 and 1971.

Table 7. Percentage share going to university and specialised university colleges by social origin

	Early 50s	Late 60s	1968	1971
Socialgrupp				
I	28	79		
	} 9	} 33	} 27	} 25
II	5	20		
III	1	9	7	6
Total	4	21	17	16
I-III	27	70		
(I+II)-III	8	24	20	19
I/III	28	9		
(I+II)/III	9	4	4	4

Sources: SOU 1971: 61 pp 143, 144

B Gesser, E Fasth: Gymnasial utbildning och social skiktning. Sthlm 1973. p 69

During the 50s and 60s the percentage share going to university increased. The development seems to have implied decreasing relative differences and increasing absolute differences comparing either social group I and III or I+II and III. 1968-71, when university attendence decreased, the social differences seem to have remained about the same both in relative and absolute terms. This stability was achieved through compensating shifts among age-groups for persons with social background III, attendence declining among the young and increasing among the old.[7)]

Let us finally cite a few results from certain follow up studies.

1. In 1970 it was found that after having finished comprehensive school 82, 46 and 25% continued to the gymnasium in social group I, II and III respectively. Considering the gymnasium plus the specialised professional school and the vocational school the rate of transfer was 98, 87 and 80% in social group I, II and III.[8)] The social differences are thus much smaller for the upper secondary school as a whole than for the gymnasium. The social differences in transfer rates remained albeit somewhat reduced taking differences in school marks into consideration.[8)]

   In this connection it is interesting to note the results from an investigation in 1961. Pupils in grade six were administered an intelligence test. From these test results expected average school marks were calculated and compared with the school marks actually obtained. Similar comparisons were also made between intelligence test results and results on standardised curricula tests and between results on curricula tests and school marks. It was found that pupils from lower social groups obtained lower school marks and lower results on the curricula tests than could be expected from the intelligence tests and lower school marks than expected from the results on the curricula tests.[9)]

2. Social differences also appear among the university transfer rates of those finishing the gymnasium. In 1972 58, 43 and 36% in social group I, II and III respectively were actively studying at the university among those who finished the gymnasium in 1970. Here too, the differences remained taking school marks into consideration. The differences were small at low levels of school marks, somewhat higher at high levels and highest at intermediate levels.[10)]

The development of these transfer rates to post-secondary education during the late 60s and early 70s can be summarised as follows:[11)]

- the proportion continuing to post-secondary education has

decreased. The proportion going to university education was heavily reduced while the proportion going to other types of post-secondary education increased somewhat

- the social differences (social group I compared with social group III) in transfer rates from the gymnasium to the post-secondary education institutions increased both in absolute and relative terms
- the social differences (social group I compared with social group III) in transfer rates from the gymnasium to the university increased in relative terms but not in absolute terms.

The latter results with respect to social differences in transfer rates gymnasium-university do not necessarily contradict the earlier result: constant social differences both in absolute and relative terms in the percentage share of a cohort going to university. A change in the social composition of the student body at the gymnasium can compensate for increased differences in transfer rates.

3. Once at the university [7] students with different social background seem to obtain degrees to the same extent. As for educational reorientation (mostly from free to restricted faculties) students belonging to social group III seem to utilise these possibilities to adaptation to a lesser extent. There is also already at the university entry a difference as these students less often go to the restricted and more prestigeous faculties.[12]

International comparisons

Let us first note the results of a comparison in financial terms. An investigation was made to find out how expenditure varied by schools having different social compositions of their student body. The information is from the middle of the 60s and concerns 13 year old pupils. For Sweden the method of classification used resulted in the distinction of only two types of schools: those where the majority of pupils had fathers with high status occupations and those where the majority of pupils had fathers with low status occupations. Expenditures per pupil as well as achievements were higher in the former type of schools. The differences were, however, very small. The distribution of resources between various types of schools seems to be more egalitarian in Sweden than in England, West Germany or the U.S.A. However, analysing the effects of different modes of resource allocation (egalitarian versus elitist) and school system structure (comprehensive versus selective) it was concluded that differences in these two respects do not seem "to have much impact on overall level of achievement or the social distribution of achievement".[13]

Statistics from OECD, for 1970, permit international comparisons of intergenerational differences. Comparing the 30-34 and

55-64 year olds it turns out that at the primary level differences are small in most countries. At secondary and higher levels differences are more important. Sweden has the highest differences after Japan and Finland at the secondary level and after the U.S.A. and France, at higher levels. The same OECD-statistics also show that within generations the dispersion (as measured by the Gini-coefficient)[x] has increased in Sweden (again comparing the 30-34 and 55-64 year olds). The same development was noted in eight other OECD-countries (e.g. Denmark, France, West Germany, Norway and the U.K.) while in ten other OECD countries (e.g. Canada, Japan, the U.S.A., Italy and Portugal) it decreased.

The OECD has also made an effort to describe on a comparable basis the social background of students in higher education and the share in different social groups going to this type of education around 1960. Two measures were constructed that can be used to compare the social differences between countries:

- the index of dissimilarity indicating differences in the social composition of the student body and active male population
- relative chances of upper-stratum and lower-stratum youth studying in a university.

Graph 19 summarises the results. It can be seen that Sweden does not occupy a leading position as to low social disparities. The development during the 60s as followed up by the OECD shows a tendency towards equalisation. Due to differences in social classifications we cannot, however, say whether this development was faster in Sweden than in other countries or if Sweden still would rank as low as in 1960.[15]

4.2 Education and the distribution of income

The data at our disposal to illustrate the relation between education and income are of two types: individual and grouped. In the first part of this section a few studies based on individual data will be presented. An important question in these studies has often been how social background and education interact and affect occupation and earnings. With respect to the relation between social background and education they can thus complement the grouped data presented in the preceding section. The second and third parts of this section use grouped data to describe the average income of different educational groups for example by age and sex and at different points in time. In part four the development of the income

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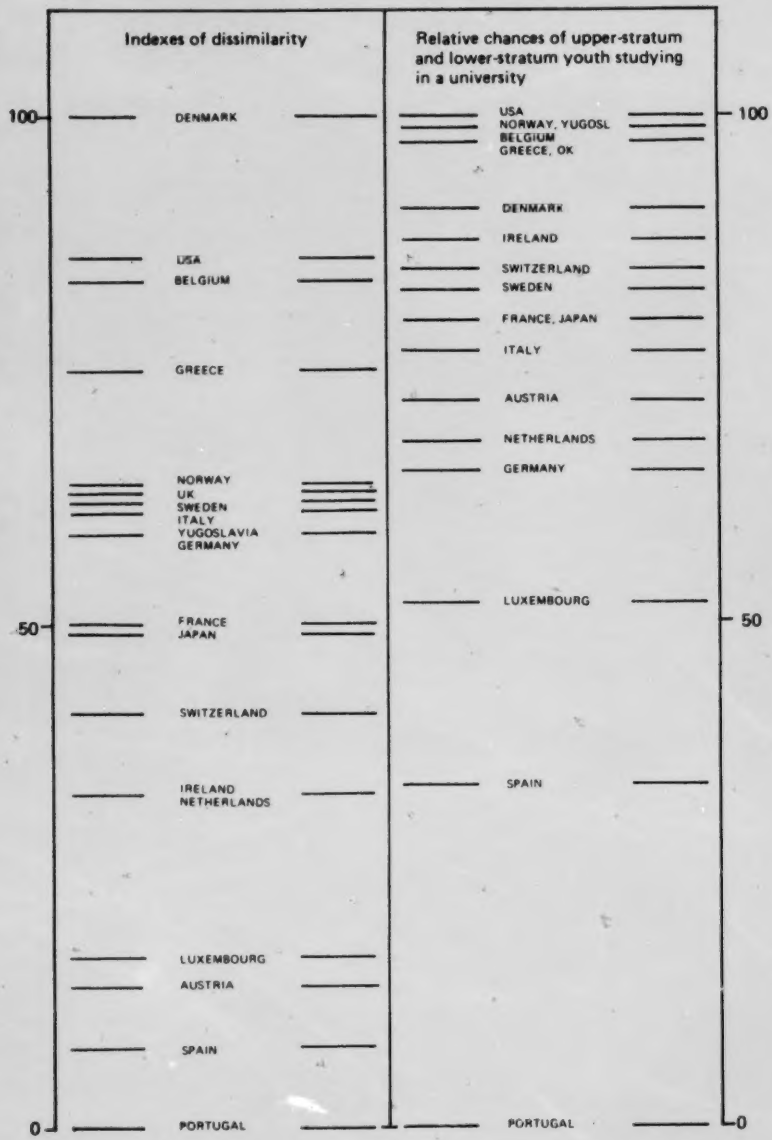
x) The coefficient of concentration or Gini coefficient varies from 0 - 1, a lower numerical value indicating less inequality.

Graph 19. Ranking of countries according to their index of dissimilarity and the relative chances of youth studying in a university



The country in which, according to the index adapted, social disparities seem lowest has been classified at 100, the country in which these disparities seem widest has been classified at 0. The other countries have been ranked relative to these two extrems.

Source: OECD. Group distarities in educational participation and achievement IV. Paris 1971 p 69

distribution in terms of educational changes is discussed. Finally in part five some international comparisons are made.

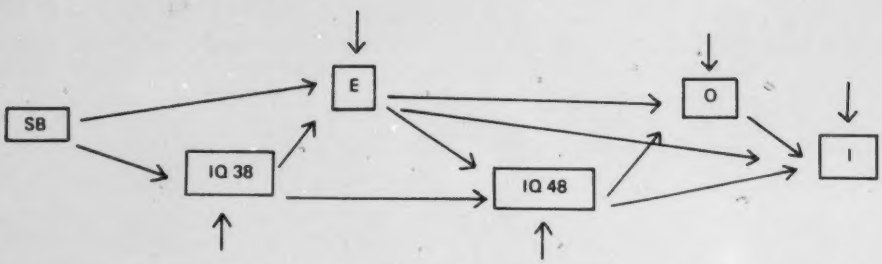
4.2.1 Individual earnings and correlated variables

There are several studies of this type. The first two presented here study the whole chain: social background, education and earnings and the last two only the relation between education and labour market variables.

Social background, education and earnings

A regression analysis based on dummy variables was used to investigate the relation between incomes in 1963 of a sample of men 35 years old and social background (4 classes), IQ test results in 1938 (5 classes) and education (4 classes).[16] Only the coefficients for the highest social class, the two highest IQ-classes and the two highest educational classes were found to be significant. A man from the lowest social group, at the lowest IQ and educational level could be expected to have an income of 13,690 Skr whereas a man from the highest social group, at the highest IQ and educational level could be expected to have 46,880 Skr. 46% of the income difference could be "attributed" to differences in education, 32% to differences in social background and 22% to differences in IQ test scores. Studying interactions it was found that education in combination with high IQ and high social class contributed much more to income than what would correspond to additivity of the effects. Given these relations a general educational expansion would tend to increase income differences while increased education for those with the worst income perspectives would reduce income differences.

The same sample of men has later been further analysed when income data up to 1971 existed.[17] A recursive type of regression analysis (path analysis) was used. The model finally adopted roughly looks like this:



SB = different variables indicating the family situation and the social background

IQ_{38}, IQ_{48} = IQ test results in 1938 and 1948

E = education (either number of years E_1 or educational level E_2)

O = occupational status (either in 1953, 58, 63, 68 or 71)

I = log of income (either in 1953, 58, 63, 69 or 71) excluding income of capital and those with income below 12,000 Skr in 1971

Certain interaction effects were also included (SB + IQ_{38} → E, IQ_{38} + E → IQ_{48}, IQ_{48} + O → I and E + O → I).

It can be noted that the model does not include any direct relation between social background and occupation or income. The inclusion of such relations did not increase the "explanatory value" of the model for the given set of data.

The following amount of variation of different variables are "explained" by the model:

IQ_{38}	approximately	11%
E	"	40%
IQ_{48}	"	65%
O	"	40% (when the indivuduals are 30 years old or more)
I	"	5%, 10%, 35%, 38% and 52% in 1953, 58, 63, 69 and 71.

The rest of the results can be summarised as follows:

The SB and IQ_{38} variables "explain" an important part of variations in education. They are, however, not highly intercorrelated which would indicate that IQ variations rather "explain" differences among individuals with the same background than differences between groups of individuals with different social background.

There are certain interaction effects with respect to the educational system that can be of interest even though they are

not very strong. Social background and IQ_{38} interact so that those who rank high in both these respects get more education than the simple additive effect of these two variables would suggest. IQ_{38} and E have a negative interaction effect on IQ_{48}. Thus the selection process in the educational system seems to have created certain losses of talent. The direct effect of E upon IQ_{48} is, however, positive as well as that of IQ_{38} (both directly and via E).

The E-variable has important direct effects upon occupation. Furthermore, it strongly affects income directly (especially E_2) as well as via occupation. Education cannot, however, be said to be the sole decisive factor in accounting for differences. Social background and the IQ-variables are also involved. Sometimes IQ_{48} has a direct effect upon income even though it is not as great as that of E. Moreover, important effects via E and O can be attributed to social background and the IQ-variables because of their correlation with E further back in the chain.

In certain respects the model gives different results when E_1 (years of education) and E_2 (level of education) are used:

- SB and IQ_{38} have stronger effects upon E_2 than upon E_1 (which agrees with our previous results that social differences are greater for Higher Leaving Certificate than for 12 years of education)
- using E_2, IQ_{48} has generally no direct effect upon O and I
- E_2 has a stronger direct effect upon I than E_1
- E_1 and O have positive interaction effects upon I but E_2 and O do not.

These results are somewhat intriguing. E_1 and E_2 are rather highly interrelated (the simple correlation coefficient is 0.81). E_1, however, also measures a certain amount of grade repeating and is less highly influenced by IQ_{38}. Therefore it might be less surprising that it has a lower effect upon I than E_2 and that IQ_{48} could be needed as a complementing explanatory variable. But why does not IQ_{48} influence I in case of E_2? Over 30% of IQ_{48} is not explained by the factors in the model. Because E_2 has more of a sorting function? Apparently not, as E_1 and E_2 have about the same (E_1 somewhat stronger) indirect effect on I via O. Does E_2 at the same time measure both quantity and quality of education? Does E_2 capture more of the effects of general education and E_1 more of the effects of vocational education? E_2 has stronger direct effects on I. E_1 also has somewhat more indirect effects via O. But E_1 not E_2 interacts with O in influencing I. To some extent general ability that in case of E_1 may be captured by IQ_{48} in case of E_2 could be confounded with E_2.

As a complement let us report a few results from studies

analysing grouped data on social background, education and occupation. There is no information about income in these studies.

A sample of men living in Stockholm in 1949 was investigated as to their occupational position, education and the occupational position of their father. Similar data exist for a national sample in 1955.[18] In both samples, irrespective of the social origin of the individual, the percentage obtaining the highest occupational levels was greater at high educational levels than at low educational levels. The absolute level of these percentages were, however, higher for individuals with fathers in higher occupational positions.

An attempt was made at estimating whether the fact that children with different social background had different chances of reaching high occupational positions was mainly due to differences in education or to the impact of the social background at similar educational levels.[19] The result for the national sample was that the social background did not so much affect the occupational position by influencing the amount of education received as by influencing the occupational chances of individuals with similar education. For the Stockholm sample the result was the opposite. The social differences as to the occupational position reached could mainly be attributed to differences in education. Individuals with the same education had to a greater extent the same chances of ending up in different occupational positions. These calculations have been reproduced on a national sample from 1967.[20] The chances of reaching the highest occupational positions was mainly found to be related to educational differences irrespective of social background.

A lot of social mobility has, of course, taken place by other than educational routes. However, comparing the generations in the national sample from 1967 it appears likely that education has become more of a prerequisite for social mobility than before.[21]

Both the study based on individual data and two of the studies based on grouped data indicate that the social background has its most influential effect upon the education of an individual. Education then influences occupation and income with little further influence from social background. For the study based on individual data this was true after taking into account different factors describing the social background and personal characteristics of the individual. However, the important question from a policy point of view is what would happen if an educational policy aiming at income equalisation was built upon this relation. If the social differences in educational chances disappeared would the rest of the relations still hold?

Education and labour market variables

Income differences in 1966 were in one study[22] related to age,

education, branch of economic activity and region, for men and women separately. In one regression model these variables and their interactions "explained" 72% of variations in income for men and 66% for women. Judging the relative importance of the different explanatory variables, either by their relative net contribution to the total explanatory power of the model or the range of variation for each factor, the conclusion was that education and age were more important than branch of economic activity or region for the variation in income. Certain interactions were also of some importance:

for men - education and age
- education and branch of economic activity

for women - age and branch of economic activity
- education and branch of economic activity
- education and region

The same type of results were arrived at by studying salary differences in 1971 among government employees. The range of variation was greatest for the age and education variables followed by area of activity, sex and region.[23] These studies seem to indicate that persons of different ages and with different types of education operate in more or less separate sectors of the labour market. Regions and economic branches do not seem to give rise to different labour market conditions to the same extent. Mobility can, however, be a precondition for gaining a proper return to education.

4.2.2 Present income differences among educational groups

In an attempt to describe the income differences among educational groups at present we will first use a few cross-sectional materials (from 1972, 1971 and 1966), then we will compare the income of recent graduates at different educational levels. Finally, we report the results obtained from calculating the life-time earnings for different educational groups. This is, by the way, the only instance where we can compare what the differences look like before and after taxes.

Income differences in 1972, 1971 and 1966

Graph 20 depicts the income situation, by age, for different educational groups in 1971. Only full year and full time employees have been included. Income refers broadly to labour income before taxes and transfers but after certain cost deductions.

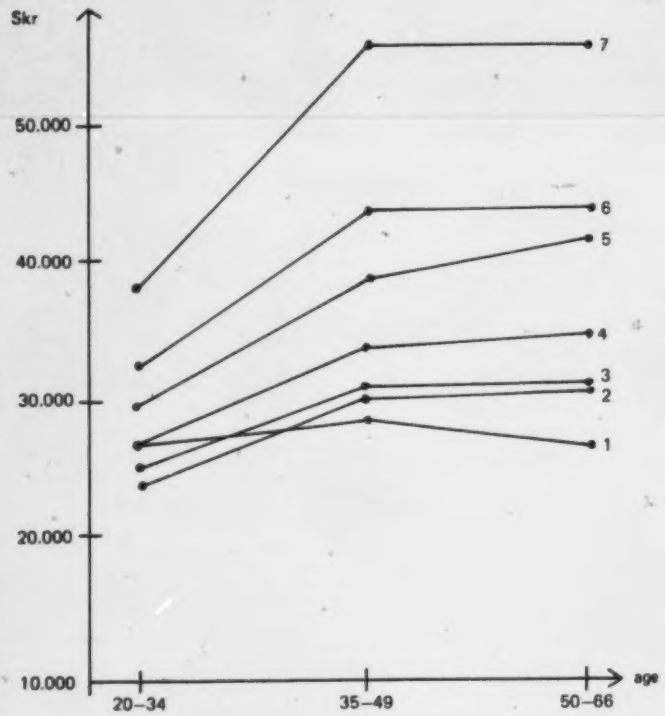
The differences in median earnings among educational group 1-4 are fairly small especially for the youngest age-group. The distance from these educational groups to the highest one is considerable and greater among the older. The rela-

tive income differences in the three successive age-groups looks as follows:

5/2	1.3	1.2	1.3
7/5	1.3	1.5	1.3
7/2	1.6	1.8	1.8

The 1972 and 1966 materials give the same general picture for persons working at least half of the year and full year and full time employees respectively.[24] These data also permit men and women to be examined separately. At all educational levels and in all age-groups the income of women is lower. This is especially true at higher educational levels. This means that for women the income differences among educational groups do not increase with age to the same extent as for men.

Graph 20. Median income 1971 for full year and full time employees by age and education[1]



[1] For the definition of educational levels 1–7 see graph 7

Source: SCB Statistiska Meddelanden Nr Be 1973:12 p 15

Let us also report some information comparing earnings in 1971 for employees at different educational levels working for

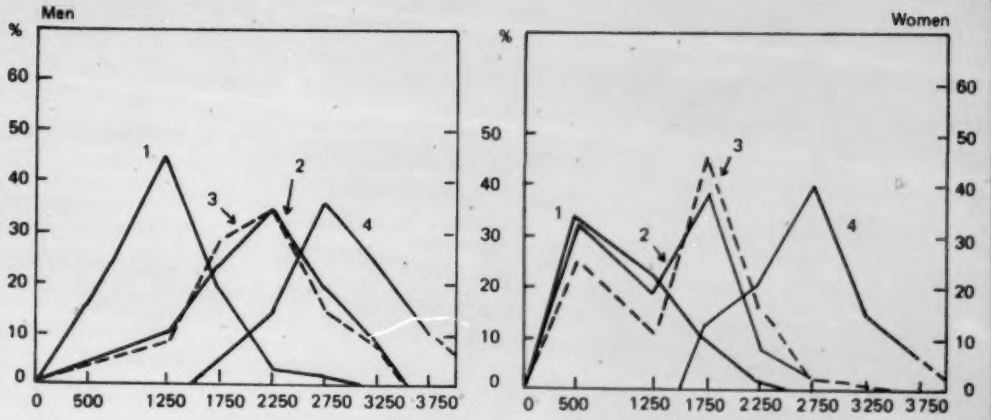
the private and public sector respectively.[25] Three educational levels can be distinguished: university, upper secondary (excluding vocational lines) and other education (i.e. mostly pre-upper secondary and vocational upper secondary). For university male graduates earnings were, in all age-groups, higher in the private than in the government sector. The differences were most important in age-groups 35-55. For female university graduates earnings were about the same in both sectors. At the upper secondary level, for both men and women earnings were somewhat lower in the private sector up to 20-25 years and higher for older people, especially for men. The same pattern is found at the lowest educational level for men but not for women. For them the earnings in the government sector were higher in all age groups.

Let us also give a few indications about the income variations within educational groups. The 1966 material[26] shows for men both the absolute spread (as measured by the decile distance D_9-D_1) and the relative spread (as measured by $(D_9-D_1)/D_5$) to increase within a given age-group with educational level and within a given educational group with age. This means that the spread is quite substantial within the oldest age-group at the highest educational level. A more detailed study of the government employees (males) arrived at less regular results.[27] The standard-deviation was for each age-group higher at higher educational levels but only for those with secondary education did it rise monotonically with age. For those with high education it rose, leveled off and finally decreased. The same type of irregular pattern was also observed at the comprehensive educational level. The patterns as to relative spread (standard-deviation as a percentage of average salary) were even more irregular. For no educational group did it rise monotonically with age. For a given age-group those with secondary education most of the time had the highest relative spread. In this study it was also demonstrated that the overlaps in earnings for different age-groups was much greater at lower educational levels. Those with high education only seldom fell within the normal wage interval of those with lower education.

Recent graduates

The distribution over income classes of those leaving the educational system around 1972 at different educational levels, 6 - 12 months after graduation, is given in graph 21. As higher educational level roughly means that the whole distribution of monthly salaries is pushed to the right. The differences between those leaving the upper secondary school after 2 and 3-4 years on theoretical lines are, however, practically non-existant. It can be added that among those with lower education and among women there is a greater proportion gaining practical experience which presumably lowers their earnings.[28] However, judging by the previous figures this is not a fact which is compensated for later.

Graph 21. Monthly salaries in the spring of 1973 for persons working full time who have completed their comprehensive schooling (1), 2-year "theoretical" lines (2) and 3–4 year lines (3) in upper secondary schools and salaries 6 months after graduating for those having a first-degree from universities and specialised university colleges (4)



Source: SCB IFP 1974:8 Trender och prognoser 1974 p 180

For graduates from university and specialised university colleges we can make comparisons between certain groups with different educational orientation.[29] No information, however, exists for graduates from the faculties of medicine, dentistry and pharmacy.

The highest median earnings among men with full time work in 1972/73 six months after graduation were found for Masters of Arts from the faculty of liberal arts, of technology, of natural sciences and Bachelors of Arts from the faculty of technology and the lowest for Bachelors of Arts from the faculty of natural sciences, of social sciences and of liberal arts. The corresponding highest median earnings for women were found for Bachelor of Arts from the faculty of technology and journalists and the lowest for Bachelor of Arts from the faculty of liberal arts, of Economics and Business Administration and of natural sciences. For every type of degree the earnings of women were lower than those of men. The difference varied from 1% to 27%.

The earnings of these graduates also vary with occupational field. The salaries of teachers, for both men and women, are far above other salaries. For educational lines preparing for this as well as for other occupational fields the labour market conditions for those who gain access to the educational field are very different from those in other fields, such as administration and clerical occupations. Investigating the income differences among graduates from the faculties of liberal arts, social and natural sciences excluding teachers the earnings do not vary much with educational orientation and earnings differences between men and women are also somewhat reduced.

Besides the educational field, salaries are also nigh in technical and mathematical fields for men and in the fields of journalism, psychology and law for women.

Life-time earnings

So far we have compared the earnings of different educational groups within age-groups. Higher education normally implied higher earnings and lower risks of unemployment. However, persons with higher education may be expected to spend a shorter time on the labour market and may, during the educational period, have certain extra costs besides the earnings foregone. It is interesting to take all these factors into consideration simultaneously. Summing up the earning differences over the whole working life of individuals with different education, including the direct educational costs as negative income during the period of prolonged education, would be one way of doing so. For this we can either use longitudinal or cross-sectional data. In the first case you describe the differences really experienced by a cohort of individuals but produced by an educational system different from the present one. In the second case you have in the younger age-groups individuals that recently left the educational system but the life-time earnings are calculated on income differences in older age-groups influenced by the educational system at an earlier period.

Let us therefore present both types of data beginning with life-time earnings calculated from a cross-sectional material for earnings in 1968. Table 8 indicates, for different types of higher education, how much higher the life-time earnings are compared with those of a secondary school engineer. Separate calculations have been made for men and women, before and after taxes. It should be noted that the results are:

- for undiscounted earnings
- including direct educational costs. Earnings before taxes are combined with total direct educational costs (both those of the individual and those of the state) and earnings after taxes with the direct educational costs of the individual only
- for women based on a comparison with the earnings of the male secondary school engineers reduced by 40% in the case of earnings before taxes and by 30% in the case of earnings after taxes
- obtained when the earnings of the highly educated are estimated for groups that include both economically active and not economically active individuals whereas the earnings compared with only refer to economically active persons. For the latter, however, earnings do not include overtime and other extra earnings nor are individuals for whom earnings

Table 8. Differences in life-time earnings between individuals with different types of higher education and secondary school engineers. Cross-section in 1968 (1.000 Skr)

	Women		Men	
	Before taxes	After taxes	Before taxes	After tax
Type of higher education:				
Medicine	1,100	490	1,900	650
Business and Administration	- 80	- 50	860	340
Law	260	90	760	240
Technology	170	90	640	290
Dentistry	300	140	570	240
Natural sciences	240	80	320	100
Social sciences	30	- 20	230	40
Foresters	20	- 60	130	40
Liberal arts	70	20	60	- 40
Agriculturists	- 380	- 200	- 90	- 40
Social workers	- 160	- 110	- 130	- 100
Theology	- 160	- 120	- 240	- 160

Source: I Ståhl: U74. En samhällsekonomisk analys av den högre utbildningen. Malmö 1974 pp 39, 46
SOU 1972:23 pp 147–148, 186, 188, 194, 196

are negotiated individually included. However, a secondary school engineer, presumably has higher earnings than the average secondary school leaver

- the income concept used is income from all sources after deduction of certain costs and deficits.

Calculated in this way the life-time earnings before taxes are higher for all types of higher education except for the agriculturists, the social workers and the graduates from the faculty of theology plus Business and Administration for women. As a rule the differences in life-time earnings for women are lower than for men. Weighing the different types of education by the number of graduates we arrived at an average rate of return of approximately 4% for men and 3% for women.

After taxes the differences in life-time earnings are generally lower. This means that in case of a life-time earnings differential in favour of the highly educated it is reduced after taxes sometimes so much that it turns into a negative differential. When higher education yields a negative differential already in the calculation before taxes the negative differential becomes smaller after taxes. In many cases the differential, however, remains positive even after taxes. The only new negative figures besides those that were negative already in the calculation before taxes are for liberal arts graduates for men and for social scientists and foresters for women. However, altogether this means that for women 6 out of 12 and for men 4 out of 12 of the different types of higher education in table 8

give lower life-time earnings than those of secondary school engineers. A weighed average of the rate of return would very approximately be somewhat below 4% for men and 3% for women.

As a complement let us cite a few results obtained from cross-sectional material describing the salary differences of male government employees in 1971.[30] Comparing university gratuates and graduates from upper secondary school with persons having only comprehensive education the rate of return before taxes was found to be 7.3% and 4.7% respectively. The larger investment thus gives a higher return. The ranking between different types of higher education was about the same as in table 8, that is high returns for medicine, business and administration, law, technology and dentistry and low returns for liberal arts, social workers and theology. At the upper secondary level the highest return was noted for those finishing longer theoretical lines. The returns after taxes were reduced for liberal arts graduates from 8 to 4% and at the upper secondary level for those finishing longer theoretical lines from 11 to 7%.

Finally let us report the results from a synthetic cohort investigation.[31] Only certain groups of engineers and economists were studied and direct educational costs disregarded. The results thus arrived at in terms of rates of return to higher education for a cohort born in 1930 were:

	Before taxes	After taxes
graduate engineer/upper secondary school engineer	17%	12%
graduate engineer/lower secondary school engineer	19%	14%
graduate economist/upper secondary economist	18%	13%

Once more we note that the rate of return is lower after taxes. The absolute level of the rate of return is, however, much higher here.

4.2.3 Development of income differences between educational groups

Our possibilities to investigate the development of income differences between educational groups parallel to the educational expansion are rather limited. In table 9 we have, however, put together some approximately comparable data concerning the earning ratios for university graduates and persons with upper secondary and comprehensive education in 1934, 1960, 1966 and 1971. Before making the rather risky attempt at comparing these figures let us first comment upon the 1934 and 1960 data.

In 1934 salaries as well as other aspects of the labour market situation for different types of university graduates was investigated by officially appointed experts. Their appointment was to a certain extent due to apprehensions concerning the labour market situation for graduates and the increasing supply of graduates. This means that the income figures they collected may be low if they are to represent a more normal situation before or at the beginning of the educational expansion. This is, however, probably true to a lesser extent for the earning ratios. Moreover, the income figures are only for full time full year work at regular occupational posts. For an important group of university graduates (i.e. those employed in higher education) there are no earning figures. For the rest of the public sector and the private sector consisting of banks, insurance companies, railways and the manufacturing industry the data were indicated to have a good coverage or at least to be representative.

As can be seen in table 9 the median earnings of university graduates are normally higher than for persons with only a Higher Leaving Certificate. There are certain exceptions: the lawyer at the beginning of his career in the public sector and the liberal arts graduate in banking whose salary never exceeds that of a person with a Higher Leaving Certificate. Besides these cases the income differential varies from 10-90%. It is frequently higher in the lower age-groups which may be surprising. It also seems to be somewhat higher in the private than in the public sector.

Table 9. Ratios of median earnings in 1934 and 1971 and ratios of average earnings in 1960, 1966 and 1971

1934		Age - 35	35 - 50	50 -
University graduates/persons with Higher Leaving Certificate by educational orientation of graduates and by economic sector				
medicine	P	1.4	1.3	1.2
dentistry	P	1.9	1.4	1.2
law	P	0.9	1.5	1.4
"	B	1.9	1.7	1.2
"	I	1.8	1.5	1.0
technology	P	1.3	1.3	1.4
"	I	1.9	1.5	1.1
"	R	1.9	1.6	1.6
"	M	1.8	1.5	1.2
liberal arts, natural and social sciences	P	1.1	1.2	1.2
"	B	0.7	1.0	1.0
"	I	1.6	1.3	1.1

P = public sector I = insurance company M = manufacturing industry
B = bank R = railway

Table 9. (page 2)

1960 (Men only) Age	- 30	30 - 40	40 - 50	50 - 60	60 -
University graduates/persons with Higher Leaving Certificate by educational orientation of graduates and total					
medicine	4.8	1.5	1,9	1.5	2.5
technology, law, social sciences	3.1	1.3	1.7	1.3	2.1
theology, liberal arts, natural sciences	2.0	1.0	1.1	1.0	1.3
all first-degrees	3.0	1.3	1.5	1.2	2.1

1966 (Only male government employees)	20	30	40	50	60
University graduates/upper secondary education	-	1.4	1.5	1.6	1.6
Upper secondary education/comprehensive education	1.2	1.2	1.3	1.4	1.4

1971 (Only male government employees)					
University graduates/upper secondary education	-	1.4	1.5	1.5	1.5
Upper secondary education/comprehensive education	1.0	1.1	1.2	1.3	1.3

Table 9. (page 3)

1971 Age	20 - 35	35 - 50	50 - 60	Total	
				Men	Women
Post-secondary education more than 2 years/upper secondary education more than 2 years	1.3	1.5	1.3	1.5	1.4

Sources: SOU 1935:52 pp 139–367, SOU 1963:74 pp 277–281, SCB:SM No Be 1973:17
S Gustafsson: Lönebildning och lönestruktur inom den statliga sektorn. Uppsala 1976 p 135

The 1960 figures are for average income but not only for those working full time and full year but all university graduates and persons with academic Higher Leaving Certificate irrespective of degree of economic activity. This of course makes comparison with figures for 1934 more difficult but they can be of interest in themselves, combining the effects of earnings per hour and hours worked. The average earnings are higher for university graduates in all instances except for the earnings in certain age-groups of graduates from the faculties of theology, liberal arts and natural sciences which are equal to those of persons with a Higher Leaving Certificate. The relative

differences are highest for the youngest age-group and later decline though there is not much of a regular pattern in this decline.

Now, making comparisons the following complications should be kept in mind:

- differences in age-groups
- differences in definitions of educational groups. In 1934 the university graduates working in higher education are lacking. The difinition used in the second set of 1971 figures is wider and includes more types of higher education
- in all cases except for 1960 the earnings are for full time, full year employment. For 1960 only the results for men are shown as they can be assumed to be less influenced by differences in labour market participation. The data for 1966 and the first set of 1971 figures are only for male government employees
- the ratios are for average earnings except in 1934 and 1971 (second set) where median earnings ratios are reported. The 1960 income concept is wider including earnings from different sources while for other years only labour income (though not exactly defined in the same way) is reported.

Together all this means that these data do not constitute any ideal material for drawing conclusions about the long term development of income differences. However, let us consider the pattern of wage ratios by age-groups. In 1966 and 1971 it looks different from the one in 1934 and 1960. In 1966 and 1971 it is not highest among the youngest and then falls but first rises and then levels off or even falls back in the older age-groups.

As for the absolute level of the wage ratios university/upper secondary education it appears to be lower in 1971 than in 1960 and 1966. Compared with 1934 the level of the 1971 wage ratios seems to be much more about the same.

Wage ratios for upper secondary level/comprehensive level can only be compared for the period 1966-71. Here we can definitely notice a reduction in the ratios in all age-groups. This further means that during this period the wage ratio university/comprehensive level also decreased from 1.7, 2.0, 2.2 and 2.2 to 1.5, 1.8, 1.9, 2.0 in the respective age--groups.

As a complement to this information let us add a few results from certain special investigations as to the development of certain wage ratios in the private sector, life-time earnings and the situation of recent graduates on the labour market.

In table 10 for certain educational groups we can follow the development of wage ratios in the private sector 1952-70 and 1966-71. For the period 1966-71 we can compare this

Table 10. Average wage ratios 1952–70 and 1966–71 in the private and government sector (corrected for changes in age distribution)

	Private sector							Government sector	
	1952	1960	1965	1970		1966	1971	1966	1971
GE/T	1.88	1.86	1.83	1.76	U/O	1.88	1.70	1.76	1.64
USSE/T	1.29	1.26	1.25	1.20	S/O	1.33	1.24	1.32	1.21
LSSE/T	1.12	1.13	1.14	1.11					
GE/USSE	1.46	1.47	1.46	1.47	U/S	1.42	1.36	1.34	1.36
USSE/LSSE	1.15	1.12	1.09	1.09					
GEc/T	1.69	1.66	1.65	1.64					

GE	graduate engineer	U	university graduates
USSE	upper secondary school engineer	S =	USSE + LSSE + upper secondary school economist
LSSE	lower secondary school engineer	O	other education
GEc	graduate economist		
T	average wage for all non manual workers corrected both for changes in distribution over age-groups and occupational levels		

Sources: SOU 1971:62 p 217
S Gustafsson op cit p 206

with the corresponding development in the government sector. These figures are only for males and standardised for age and 1952-70 for the total even for changes in the distribution over occupational levels. The development in the private sector 1952-70 is characterised by rather stable wage ratios. Towards the end of the 60s a certain tendency towards lowering ratios for graduate and upper secondary school engineers as compared with the average can, however, be observed. The over all stability is all the more impressive as considerable fluctuations in the numbers recruited were registered during this period.[32] However, the data 1966-71 show that the decrease in wage ratios may have accelerated towards the end of that period. The development is about the same in the government sector though the level of the ratios are lower especially for university graduates.

As for the development of life-time earnings we have certain information from 1934, 1960-68 and 1966-71.[33] The calculations for 1960 and 1968 (see table 8) are comparable and show that for males and most of the different types of higher education considered the differences in life-time earnings increased. Exceptions were engineers and social workers. For 1934 the

approximately corresponding gross difference for the lawyer and the upper secondary school leaver in public employment was estimated at 33,000 Skr. In 1968-prices this would correspond to about 120,000 Skr which is very much less than the figure for the lawyer both in 1960 and 1968 (760,000 Skr).

The calculations for 1966 and 1971 are also comparable. They show that for the male government employees the rate of return before taxes fell from 10.4 to 8.3% and from 10.3 to 6.6% for respectively university and upper secondary school graduates as compared with the comprehensive level.

Several investigations have been made concerning the development of the labour market situation for university graduates during the 60s and early 70s. However, we cannot draw any conclusions from them as to the development of the relative position of university graduates, i.e. relative to other educational groups. As for the development of the absolute position of graduates on the labour market they point to a certain deterioration:

a) The development 1966-73 within the public sector with respect to the educational composition of persons under 30 recruited for certain appointments. Here the percentage "university graduates" rose considerably (from 21 to 45%). Above all they have come to make up a much greater percentage of those recruited for lower salary grades. This is especially true for the men. The share of persons with other types of higher education has also increased which means that the percentage for lower educational groups has been reduced among those recruited for these appointments.[34)]

b) Similar figures exist for the field of the Swedish Confederation of Employers for male university engineers and economists. Between 1960-70 the average occupational position for newly appointed university engineers declined while it first rose and later declined for the economists being about the same at the beginning and end of this period. Further, keeping the level of occupational position recruited constant, it was found, for engineers that at the occupational level formerly dominated by upper and lower secondary school engineers, more than 50% were university engineers by 1970. Similarly among economists, lawyers and social scientists recruited for certain occupational levels. In 1970 university graduates made up a greater share than secondary school economists which they did not do in the beginning of the 60s.[35)]

c) The salary position of university graduates 6 months after graduation that we already described for 1972/73 can be followed back to 1967/68. For most

groups the nominal salaries in 1972/73 are but a few percentage points above those in 1967/68. The exceptions are for men university engineers, lawyers and Masters of Arts from the liberal arts faculty and for women social workers, lawyers and Bachelor of Arts from the liberal arts faculty. Among the liberal arts graduates the more positive development mainly occurred for tachers.[36]

This information indicates that the entry into the labour market has become more difficult for university graduates even though this might not be so in relative terms. Moreover, it may be compensated later. It has been noted that at least for certain types of higher education those who are recruited at lower occupational positions have a more rapid career development.[37] Also, the differences after 3 years of labour market experience between certain classes of university graduates were much smaller than at the entry into the labour market. Those who graduate when business activities are low may get lower salaries and, to a higher degree, unqualified tasks but later the differences may disappear.[38]

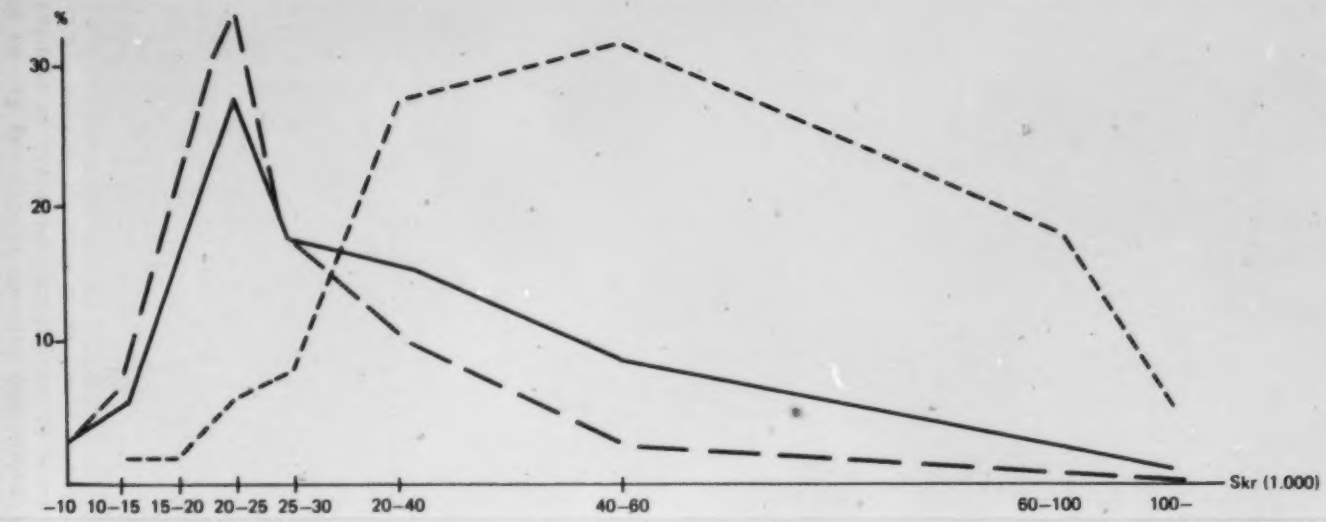
4.2.4 The income distribution

So far we have discussed income differences among educational groups measured in different ways. What about the income distribution? The distributional objectives mostly refer to some income distribution that ought to be equalised. Which one is less clear. When you describe the income distribution you have to decide upon what group to study (the whole population, the labour force, those employed, men, women, a certain age-group etc.) and how to define income (total income from different sources, income from employment, life-time earnings, annual earnings, income before or after taxes etc.).

Graph 22 illustrates the 1966 distribution of income from employment for males full year and full time employed aged 14-74. The distribution within the highest and the lowest educational groups are also shown. Given the shape of these distributions and the fact that most individuals belong to the lower educational groups and very few to the higher educational groups the over all income distribution is centered around the lower income classes but with a prolonged right-hand-tail.

Fundamentally, and for the same reasons the income distribution would have the same shape if we draw it up for the 1971 earnings data, for more restricted age intervals in 1966 or 1971, or for those who in 1972/73 had recently left the educational system at different levels. Our possibilities to relate the development of some such over all income distribution during the period of educational expansion to changes in the distributions within and between educational groups are, however, practically non-existant.

Graph 22. Income distribution 1966 for males full year, full time employed aged 14–74



Source: SOU 1970:34 p 115

The Swedish income distribution may be said to have become less uneven during the period 1951-73. If we study the annual income (income from all sources after certain cost and deficit deductions but before taxes and non taxable transfers) of the population aged 20 years or more the following can be noted:[39]

- the share of total income accruing to the highest deciles has decreased while it has increased for the lowest deciles. Studying men and women separately this development has, above all, characterised the distribution for women. For men, the situation in 1973 was about the same as in 1958 as a result of a certain tendency towards inequalisation up to 1968 and towards equalisation after that
- the coefficient of concentration[x] continually declined from 1951-73 and more rapidly so after 1968. Again this tendency was strongest for women. For men, the coefficient rose somewhat up to 1968 and later fell being about the same in 1958 as in 1973.

Also the after tax income distribution can be said to have become more even. The differences in income inequality between the income distribution before and after taxes also seem to have widened especially after 1964 which may be interpreted as an increase in the equalising effect of taxes.[40]

This type of income statistics, of course, do not include any educational variables. As was seen above we were not very successful in finding earnings data by education from other sources. If we want to describe the long term development of the income distribution as related to educational changes we must know both the quantitative development of different educational groups and the income differences between educational groups. Neither type of data exists in abundance. What is especially lacking are data concerning the wage differences among lower educational groups (primary, comprehensive and upper secondary school). It is at these levels that the greatest educational changes have taken place. For higher educational levels more information exists but uncertainty arises due to the incomparability of data. Instead of drawing any definite conclusions this tentative interpretation of data is proposed:

- the expansion of higher education could have been accompanied by increasing wages relative to the next lower educational level. These differences might later have stabilised or decreased
- in the late 60s the wage ratios university/comprehensive and upper secondary/comprehensive school seem to have decreased

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x) The coefficient of concentration or Gini coefficient varies from 0-1, a lower numerical value indicating less inequality.

- the expansion of higher education might, to begin with, have tended to increase the income inequality in the population. Later, as more individuals received higher education at constant or decreasing wage ratios, there might have been a tendency in the opposite direction. As a whole these effects on the income distribution of the population should have been small as only a minority was involved in higher education

- the equalising effects of expanded upper secondary education in combination with decreasing wage ratios in the late 60s could have been of much greater importance

- education can also have affected the income distribution by influencing the rate of labour force participation. The equalisation of the income distribution for women can be assumed to be partially caused by higher rates of labour force participation. Higher education can have contributed to this development

- if the income ratios do not increase or continue to decrease the income distribution for younger generations will be more equal than for older generations as they are more evenly distributed by educational levels and the relative spread in educational years probably also will be lower.

4.2.5 International comparisons

After commenting upon studies in different countries relating different explanatory variables to individual earnings we will make a few international comparisons as to relative wages by educational level, rates of return to education and education and income distribution.

Individual earnings and explanatory variables

In numerous studies, especially in the U.S.A., variations in individual earnings have been related to different explanatory variables. As methods, definitions and types of dependent and independent variables, populations investigated and time for the investigation have varied it is not surprising that the authors arrive at diverging results. Among the more extreme points of view we can note the following:[41]

- neither social background, ability nor education affect the earnings of individuals

- the social background is of prime importance for individual income

- education and training are decisive for the earnings of individuals

- ability (eventually as certified by education) is of highest importance.

We cannot go into all the details that would be required to try to explain these differences. Moreoever, in most cases there would not be any comparable studies in Sweden. Let us, however, note that the methodology by which it was found for the U.S.A. that neither social background, ability nor education "explains" earnings differences to any greater extent, very much resembles the path-analysis technique applied to the Swedish longitudinal data for individuals.[42] In the Swedish investigation the explanatory variables did, as we already pointed out, "explain" a considerable part of the variation in individual earnings. Social background mainly affected education and education affected occupation and earnings.

Relative wages

Table 11 shows relative wages by education in different countries. The figures for all countries but Sweden are taken from an international study. There are of course innumerable difficulties involved in making comparisons between countries. Definitions of educational levels differ and the coverage and comprehensiveness of earnings data vary between countries. For Sweden we have added two sets of data, those for 1972 are based on average earning for people working at least half of the year. The fact that the age distribution may vary from one educational level to another has not been taken into account. This was done for 1971 but these figures are only for the government sector. The only difference of any importance between the Swedish figures are for males where wage ratios are lower in the government sector.

The wages are about 40% higher at the secondary level. Sweden and Japan are on the low side with about 20% only. The figure for Belgium is exceptionally high.

The premium on higher education over secondary education is, in most countries, higher than on secondary over primary education. As for the ratio higher/primary level the figure for Belgium is again exceptionally high. For other countries the figure lies around 210-220. Sweden is again on the low side this time in company with Japan and the Netherlands. No clear tendency towards a lower ratio in richer countries is discernible. Compared with less developed countries the OECD ratios are, however, low. In the former countries figures around 600 have been noted.[43]

We can also try to make a few more comparisons between the

Table 11. Index of average annual earnings of labour by level of education in OECD countries

Country		Year	Educational level: Primary	Secondary	Higher
Belgium		1960	100	251	502
Canada		1961	100	144	263
France		1968	100	183	289
Greece		1960	100	139	220
Italy		1969	100	141	244
Japan		1968	100	117	161
Netherlands		1965	100	131	152
Norway		1966	100	140	213
U.S.A.		1967	100	129	200
U.K.		1967	100	140	225
Sweden	total	1972	100	122	189
	men		100	123	202
	women		100	118	173
	men	1971	100	123	175
	women		100	121	170

Sources: G Psacharopoulos, Earnings and Education in OECD Countries, OECD, Paris, 1975 p 165
SCB PM 1975:11 Utbildningsstatistik 1970–1974 p 24 S Gustafsson op cit p 181

U.S.A. and Sweden. In table 12 relative wages for full year, full time, male workers are given. In the U.S.A. the wage ratios remained remarkably stable during the 50s and 60s but between 1969 and 1973 the relative mean income of college graduates fell compared with either of the lower educational groups as can be seen in the table. The same happened in Sweden and a similar development has been reported from countries such as Japan and Italy.[43)]

As for the level of the wage ratios, and their fall, the differences between Sweden and the U.S.A. are small. Perhaps the wage ratios could be said to be somewhat lower in Sweden but the fact that only the government sector is included may overstate the case.

Rates of return to education

In an international study information about rates of return to

Table 12. Relative wages in the USA and Sweden. Full year, full time male workers by age groups

U.S.A.	25-34	35-44	45-54	55-64
College/high school graduate				
1969	1.4	1.5	1.7	1.7
1973	1.2	1.5	1.5	1.6
College/grade school graduate				
1969	1.7	2.1	2.2	2.2
1973	1.6	1.8	2.0	2.0
Sweden (government sector)	**30**	**40**	**50**	**60**
University/upper secondary				
1966	1.4	1.5	1.6	1.6
1971	1.4	1.5	1.5	1.5
University/ comprehensive				
1966	1.7	2.0	2.2	2.2
1971	1.5	1.8	1.9	2.0

Sources: R B Freeman: Overinvestment in College Training? in Journal of Human Resources, Vol X:3
S Gustafsson op cit p 135

education as calculated in different countries were gathered. In table 13 some of these results are illustrated. Certain information about Sweden has been added. The comparability of these data can, of course, also be doubted even though a great effort was made to achieve figures comparable across countries. The following limitations to comparability can, however, be noticed. The profitability measures relate to different points in time. The coverage of the studies also vary. In the U.S.A., for example, the calculations are only for white males and in West Germany only for males. In certain countries (e.g. the Netherlands and Belgium) the return to higher education has been calculated as the average for only certain university educations. The Norwegian, Danish, Japanese and British figures for higher education are only based on earnings in a more or less restricted number of sectors or occupations.

Table 13. Rates of return by educational level and country

Country	Year	Gross rates of return P/O	Gross rates of return S/P	Gross rates of return H/S	Net rates of return P/O	Net rates of return S/P	Net rates of return H/S
U.S.A.	1959	18	14	10	155	20	14
Canada	1961		12	14		16	20
Great Britain	1966		4	8		6	12
Norway	1966		7	8		7	8
Denmark	1964			8			10
Netherlands	1965		5	6		9	10
Belgium	1967			9			17
West Germany	1964						5
Japan	1961		5	6		6	9
Sweden	1968			4			3
born	1930			12			7
	1971		5 - 7				

O no education
P primary education
S secondary education
H higher education

Sources: G Psacharopoulos, Returns to Education. New York 1973, p 62 SOU 1972:23 pp 149–156
A Klevmarken m fl: Industritjänstemännens lönestruktur. Uppsala 1974 p 90 S Gustafsson op cit p 131, 134

As for the Swedish figures, the following should be said. The figures for 1968 are an average for males with certain types of higher education. They are based on cross-sectional data which, in this respect, makes them comparable to those of other countries. However, as was already pointed out the Swedish figures for 1968 are low because the group with higher education includes all individuals irrespective of degree of economic activity. The earnings compared with refer only to persons employed. For other countries the earnings data used seem to reflect both differences in wage rates and degree of individual economic activity but for both groups compared. This procedure can be expected to result in higher rates of return than if the Swedish 1968 method had been applied.

The Swedish figures, for those born in 1930, are based on comparisons between groups of employed persons only. They are, however, only for male engineers and economists. The figures have been adjusted downwards to be comparable with cross-sectional results. The figures for 1971 are only for male government employees.

In table 13 both gross and net rates of return are given. The

gross return has generally been calculated on total educational costs and earnings before taxes and the net return on that part of the educational costs the individual pays and earnings after taxes. There are, however, exceptions to this. In the case of the U.S.A., Canada and Belgium the net return was indicated to have been calculated on earnings before taxes. For the U.S.A. it was, however, noted that the net rate of return would have been about the same even if calculated after taxed earnings.

All these differences in methods and definitions make comparisons extremely difficult. Comparing the gross and net rates of return it can, however, be noted that only in Sweden are the latter lower than the former. The fact that the individual in most cases only pays for part of the direct educational costs would tend to rise the net return above the gross. The effect of taxes can be ambiguous as they, to varying degrees, both lower the earnings foregone during education and the earnings received after education.

In most countries both the gross and the net rates of return are lower for secondary compared with primary education than for higher compared with secondary education. This means that an individual taking higher education has the opportunity to make a more profitable investment. An exception in this case is the U.S.A.

The variations in net rates of return to higher education are considerable. Sweden, whether judged by the figure 3% or 7%, has a low net rate of return. The variations in gross rates are also large. The Swedish figure of 12% belongs to the higher ones but the figure of 4% to the lowest ones.

Later calculations for the U.S.A. showed that while the rate of return to higher education (college graduates compared with high school graduates) remained stable from 1959 to 1969, it was reduced by about 1/3 from 1969 to 1974. In 1974, the gross rate of return was 7.5% and the net was 8.5%.44) (In this case the net return was actually calculated on after tax earnings.) Similar tendencies have also been noted in Sweden.

Returning again to table 13 it can be seen that also for secondary education both for the gross and the net rates of return the differences among countries are quite large. The Swedish figure 5-7% is rather low.

Distribution of income and education

We will end this section on international comparisons by reporting the results from an attempt made by the OECD at investigating the existence of direct relations between the

distribution of income and the distribution of education within and between countries.[45] Information about the distribution of education could only be gathered for five countries: Canada, Denmark, France, the Netherlands and the U.S.A. Measuring the inequality in either distribution by the Gini coefficient it was found that the inequality in education was lower than the inequality in income. However, countries with the lowest income inequality did not necessarily have the lowest educational inequality. In all of these countries the income inequality decreased during the period studied. No clear relation between the rate of decrease in income inequality and reduced educational inequality could, however, be established. These data did not support the hypothesis that equalisation of the distribution of education directly influences the income distribution.

5 Summary and discussion

In this section we first summarise the development, as far as we have been able to document it in this report. Thereafter, we turn to the more complicated question of how to interpret our data. By what mechanisms are educational and other economic variables related? Do we know enough about these relations to be able to speak about the effects of education and educational policy?

5.1 The development and present situation

In the very first section of this paper we described the objectives of educational policy with respect to the labour market under the three headings: social change, distribution, and allocation and growth. Now, the expectations as to what the educational policy would achieve within these areas were never exactly stated. Of course, factors other than educational policy measures also influence these goals sometimes supporting sometimes counteracting the possible beneficial effects of the educational policy. In this part we will, however, abstract from these complications and only briefly summarise what has happened within these areas parallel to the educational expansion.

The educational system in Sweden has certainly expanded considerably. Nowadays Sweden is one of the countries with the highest educational frequences in age-groups 7-25 years. Educational frequences are, however, higher, for example, in the U.S.A. Moreover, for children of pre-school age and adults, the educational frequences are still low.

The expansion of the Swedish educational system took place during a rather short period of time. At the lower secondary level, the upper secondary level, and the university level it can be said to have started in the 20s, 30s and 40s respectively. Once the expansion started it accelerated up to the late 60s. The fact that the Swedish educational expansion started relatively late also means that the average level of education of the whole population or labour force has not yet been raised so much. Compared with other countries it is not especially high either.

Vocationally oriented education now dominates over more general education both at the upper secondary and post-secondary levels. However, while its share increased at the former level it

actually decreased somewhat at the latter during the 60s. Comparing the humanistic-social sector with the science and technical sectors we noted earlier that the former dominates both at the secondary and post-secondary levels and increased its share during the 60s especially at the post-secondary level.

The flexibility both within and in and out of the educational system has increased. Though recurrent education as, for example, measured by persons aged 30 or more at the universities has a large share of student numbers (about 20%) its volume in relation to that age-group is low (0.4%).

Summing up the development in certain distributional aspects it can for educational resources be noted that:

- The differences between generations are very big not only comparing the young and the old but also the young and the middle-aged. The volume of adult education is very small compared with this gap. The advantage of younger generations is also higher in Sweden than in many other OECD countries.

- The distribution over educational levels within generations has evened out. However, measuring by years of educational experience much less of equalising tendencies could be discerned. While the spread within an age-group (measured by the Gini coefficient) seems to have increased in Sweden it has decreased in a number of other OECD countries.

- The comprehensive school was not introduced in all districts until 1972/73. Its introduction should guarantee that for the future practically all children get a common basic education of 9 years. What this means in qualitative terms is, of course, more difficult to say. Certain investigations indicate that the results are not quite satisfactory in that respect. Moreover, there was a drop-out rate of 1-4% in grade 9. These children together with the 15-20% who do not continue to the upper secondary school do not get any formal vocational education which an education of that duration normally would have given earlier. The labour market situation for this group may become very difficult especially in the future as other forms of job training may disappear at the same rate as the vocational education at the upper secondary level consolidates.

- At the upper secondary level the distinction still exists, though in a somewhat milder form, as to who gets a practical and who gets a theoretical education. At the university level, this distinction never had the same actuality. Not until recently were the vocational technical programmes for people in trade and industry introduced on an experimental level. (276 students began such education in 1975.)[55]

- The distribution of educational resources over individuals with different social background is very unequal. Approximately 11 out of 100 children from social group III as compared with 89 out of 100 children from social group I go to post-secondary education. Also, compared with the situation in other countries the inequalities in Sweden are rather large. Comparing generations it was noted that at the lower and less formal educational levels equalising tendencies between social groups could be observed both in absolute and relative terms. At the university level the development has brought decreasing differences in relative terms but increasing differences in absolute terms. Why this diffusion process has been so slow our data do not tell us. An intensified study of cohorts could give more information about the way in which the aspirations of parents are influenced by their educational and work experience and how these in turn influence the educational choice of their children. If the social distribution of educational resources is closely linked to such adaptation mechanisms it may indeed be less surprising that it has been so slow.

As for other indicators of social welfare we noted certain differences between educational groups:

- Earnings. The differences in earnings between educational groups are rather important in Sweden though they seem to be much more substantial in other countries. The figures for Sweden and the U.S.A. are, however, very similar in spite of the fact that the proportion of highly educated is much lower in Sweden than in the U.S.A. Life-time earnings, whether calculated on cross-sectional or longitudinal data, have normally been found to be higher for those with secondary and higher education than for those with shorter education. The differences are smaller after than before taxes. The opposite situation seems to prevail in many other countries. It also seems plausible that the Swedish educational expansion has taken place at a level of rates of return after taxes lower than that in other countries.

- Unemployment. The differences among educational groups on the labour market were in this respect rather large in 1975 and about the same as they had been in 1970. However, for recent graduates the differences between educational groups in the early 70s seem to have been small although this might have been a transitional phenomenon.

- Occupations. At higher educational levels people more often end up in white collar than in blue collar jobs. Those with higher education seem to be much more concentrated in certain types of white collar jobs (professional, technical and related occupations) in Sweden than

in other countries. During 1970-75, however, certain changes occurred. The occupational profile of those with higher education shifted somewhat out of the white collar jobs and into the blue collar ones. At the same time the share in white collar jobs of the highly educated increased reducing that of other educational groups. For those with secondary education this led to a rather more substantial shift of the occupational profile out of white collar and into blue collar jobs. The occupational profile of those with only comprehensive education did not change.

- Labour force participation and mobility. The rate of labour force participation increases with educational level, especially for women. Those with higher education also seemed to be more mobile on the labour market. These factors are mentioned here as possible indicators of additional welfare effects to be associated with high education. Higher education presumably permits the individual to participate, to a greater extent, in search processes on the labour market whereby a job with not only higher earnings but also more in correspondence with personal preferences can be found. In the same way a longer educational period can permit the individual to better discover his own interests and preferences.

While these differences can be said to exist at present we found it more difficult to describe their long term development. It is possible that the differences in earnings before taxes for people with a university and a secondary education increased for a long period of time perhaps up to the middle of the 60s. In the late 60s and early 70s the differences in earnings before taxes for both university graduates and persons with secondary education, compared with those with less education, were probably reduced.

Lack of data prevented us from relating changes in wage ratios between educational groups and the relative size of different educational groups directly to long term changes in the over all income distribution. The educational expansion possibly increased the inequality of the income distribution before taxes to begin with but may have worked in the opposite direction lately. We could observe that the income distribution before taxes during the last 20 years has become more equal for women but remained rather stable for men. In the case of women the contribution of education might have been greater through influencing the rate of labour force participation than through changes in wage ratios and the relative size of different educational groups. For the after tax income distribution the equalising tendencies have probably been stronger especially lately. However, the long term development of differences between educational groups in after tax earnings, which are smaller than those before taxes, has not been possible to follow.

As for growth and allocational matters the following factors may be of interest. We note some of them once again as they were of relevance also from a distributional point of view:

- The rate of labour force participation that rises with educational level. The educational expansion may have increased the supply of labour.
- The high mobility of higher educational groups that may increase the efficiency in production.
- The low rate of unemployment of higher educational groups. The average rate of unemployment has been much lower after the Second World War than before although a certain tendency towards increasing unemployment rates have been observed during the 60s and early 70s. As we lack longer time series for unemployment rates in different educational groups we cannot say to what extent the reduction of the average unemployment rate can be associated with increasing shares of groups with low unemployment rates. The more complicated question whether lower unemployment rates for the highly educated really indicate a fuller capacity utilisation or is to be interpreted as a pure redistributional effect our data cannot answer.
- The occupational structure of the labour force has changed in the same way in Sweden as in other countries. White collar jobs have increased their share at the expense of blue collar jobs. At the level of aggregation we used (4 groups of white collar and 1 group of blue collar jobs) we found that the increased supply of highly educated 1970-74 was to a greater extent absorbed by increased densities within occupations than by the structural change in the composition of occupations at given densities. However, the density of higher educated in the economy as a whole as well as in the different occupations is still much lower than for example in the U.S.A.
- The development of the branch structure has led to an increasing share of the service sector at the expense of the goods producing sector. During the 60s the increased supply of higher educated not much more than fully corresponded to changes in the branch structure at given densities within branches. The density of highly educated within branches is also low in Sweden compared with the U.S.A. and Japan. However, it looks as if it was less behind and more rapidly approaches the densities in these countries in the service sector than in the goods producing sector.
- The above factors give a few indications about how the increased educational supply has been utilised. If we now at the macro level look at what has happened during the educational expansion we find that both GNP and labour productivity increased (except for the early 20s) during

the period we have studied. During the 50s and early 60s there were certain tendencies towards increased growth rates but later they fell back to more normal levels. This reduction thus occurred during a period when the additions of highly educated to the labour force were at its height and the educational level of the labour force grew with increasing speed. This fact, of course, only demonstrates that educational expansion by itself is not a powerful factor enough to guarantee increasing growth rates under whatever conditions. In this connection we would, however, like to add that the conventional GNP measure and measures of labour productivity based on GNP are ill suited for studying the present relation between education and production growth. In the public sector and other parts of the service sector as well, where most of the highly educated work, the value of production is estimated from the cost side which by definition excludes productivity increases.

- The educational expansion might have contributed to the growth of other aspects of welfare besides production such as job security and satisfaction. The fact that lower rates of unemployment, greater mobility and flexibility are associated with higher education point in that direction.

As for the more long term and fundamental social changes in a spirit of democracy and equality our material does not permit any firm conclusions to be drawn. While income differences between educational groups may have decreased, changes in unemployment rates and the distribution over occupations seem to have been small. A more detailed study of the development in these respects would be motivated. Especially investigations into changes of work content in different occupations and for different educational groups would give interesting information. To what extent has the increasing level of education in the labour force achieved or does it prepare the ground for new types of work organisation and changes in the structure and distribution of job tasks? What changes in attitudes are taking place and what do they indicate about what could be expected in this respect? Of course it must be remembered that only recently was the comprehensive school completely introduced and the educational expansion only slowly rises the average level of education of the whole population.

5.2 Alternative ways of interpreting the data. Possible theoretical explanatory models

Let us start by presenting four alternative (not necessarily irreconcilable) approaches to education:

1. Education as an investment in human capital for production purposes. As far as education has a durable effect

upon the individual it could be considered an investment. The effects can be of different types such as changes in stock of knowledge, in attitudes, in the ability to solve problems and to adapt. The value to the individual of this investment for production purposes, of course, depends upon a lot of things in an individual's labour market situation and his possibilities to make a career letting the services of his human capital equipment. There could both be a quantitative and a qualitative side to human capital.

2. Education as sorting. The individuals leave the educational system at different levels equipped with various types of certificates. In an educational system with a pure sorting function the classification would be based on innate ability or some other characteristica not influenced by education e.g. social background. It may be appropriate to make a distinction between capacity sorting and social sorting as those phenomena are likely to appear for quite different reasons and in different social contexts.

   Education could of course also fulfil a double function both improving e.g. cognitive abilities and certifying the existence of these cognitive abilities. The value to the individual of the sorting depends on his alternatives being sorted or not.

3. A search and information perspective could be applied to education as well as the whole life of an individual. The individual successively finds his way at the same time as his information about himself and the world around increases. Education is part of this process as well as it furnishes information.

   This search approach would of necessity lead to a multidimentional perspective on education and educational output that may or may not be incorporated into the human capital and sorting approaches. It would tend to stress dynamic elements in the educational process and education as a means to reduce uncertainty. It would include both investment and sorting elements.

4. Education as a value for other than production purposes. Individuals can participate in educational activities for the pleasure of so doing. It can also be a value of more durable character for activities in other than the production sphere such as the cultural, political and consumption sphere.

To be able to discuss the value of education outside the school both to the individual and the society at large you apparently also need to have an idea about the way the rest of the economy and the labour market works. One extreme view of the labour market is to regard it as a smoothly functioning market with perfect competition and mostly characterised by general equi-

librium. Supply and demand for different factors of production would determine their respective rewards. Another extreme would be to completely deny the influence of market forces, and to see the conditions on the labour market as set by existing institutional conditions, the type and stage of development of the economic system. Education might influence the labour market but only indirectly via institutional change. In less extreme versions the existence of barriers to a smoothly functioning labour market and the influence of institutional factors may be given more or less emphasis.

The Swedish educational policy with respect to direct effects upon the labour market can be said to have been based mainly on a human capital approach, that is, education as an investment for production purposes. This has been coupled to a view of the labour market where institutional factors have a large influence especially on the long run development and where market forces do operate within the given institutional framework but not with perfect smoothness.

Let us first discuss what view of the labour market seems warranted by our data and then against this background more in detail analyse the role of education and possible explanations of the association between education and earnings. Of course these two questions are intimately related but a division of the discussion along these two lines may clarify certain issues.

5.2.1 The labour market

Whether the labour market functions in a smooth way according to the competitive market model reasonably close to general equilibrium or not has important implications for the interpretation of data.

Guidelines for educational policy in view of reaching efficiency and distributional goals might also be more easily obtained in case of a competitive market. Income differences could in that case be interpreted as differences in productivity. When a given production factor is paid the same price in all uses production could be regarded as efficiently organised at least from the point of view of firms. Of course policy makers might want to apply another valuation when planning to increase or decrease the supply of different types of educational groups or weighing educational expansion against other types of activities but the valuation made by the market may be a good starting point. Moreover, if private and social valuations were in line with each other the government may just supply the amount of education demanded by individuals and let the labour market take care of the adaption of supply to demand for different educational groups at least as far as only efficiency goals are considered. Distributional effects of changes in educational policy could also be predicted.

Our intention is not, however, to make a full-fledged evaluation from a welfare economics point of view of the results of the Swedish market system in educational respects. In this part we are going mainly to discuss the more restricted question whether the same or different prices are being paid for one factor of production. Such an analysis is of interest as it could indicate to what extent the Swedish labour market operates smoothly according to the competitive model.

In a competitive market one would, with certain qualifications, expect a single price to be established for every factor of production and that this price would correspond to the marginal productivity of the factor in question. For labour it would be possible to distinguish different factors of production according to varying qualifications or productive capacities. Individual differences in productive capacity could for example be due to differences in innate ability and education. For every such factor of production we would thus expect one price to reign. Before we get to the qualifications and the difficulties of identifying different factors of production in case of labour let us schematically illustrate the difference between a competitive and a less competitive market. In figure 4a two factors of production, for example individuals with longer and shorter education, are supplied (S_1, S_2). For each category there is only one price. In figure 4b there are two demand curves (D_1 and D_2) which results in two different prices being paid for each factor of production. Such a segmentation could

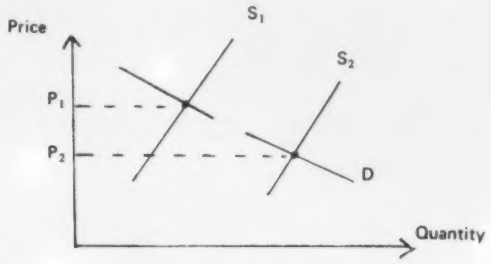


Figure 4a

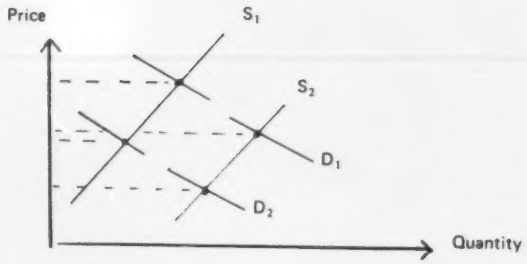


Figure 4b

indicate inefficiencies in production. Moreover, income differences now do not only stem from different demand and supply conditions for different factors of production, i.e. people with different productive capacity, but also from different demand and supply conditions for the same factor of production.[46]

In certain instances, however, even with a highly competitive market different prices could be found for the same factor of production:

- when non-pecunary aspects are to a varying degree associated with different jobs
- when the reward, pecunary or non-pecunary, in different jobs are evaluated differently
- when adaption costs, both on the side of demand and supply, prevent factor price equalisation
- in the short run when adaption has not yet taken place.

Observing a situation like that in figure 4b we cannot always be sure that we are really dealing with different situations for the same factor of production rather than different situations for different factors of production. Within educational groups one should try to standardise as far as possible for personal capacity related characteristics. As for education, the situation of people with the same type of education could be compared. However, in a competitive market certain relations between the earnings at different educational levels and for different types of education at a given educational level would also be expected. The private rate of return to different types of education could be expected to be equalised.

Our data only permit a limited number of comparisons to be made. Out of the data presented earlier in this report we would like to point to the following evidence that seems to indicate the existence of segmentation:

1. As we saw earlier there may exist a dual kind of labour market where some people, the young, women, and immigrants, can get caught unwillingly for shorter or longer periods of time without having worse qualifications than people not working there.

   An investigation of individuals with low pay[47] (less than 7 Skr/hour) made in 1967 showed that 15% (14% excluding students) of those employed got such a low pay. Low pay was more frequent among women than among men and much more frequent in younger age-groups (76% as compared with 8% in age-groups 25-44 and 25% for those older than 45 years). No one with a Higher Leaving Certificate or higher degree belonged to this group. In the other educational groups the percentage belonging to this group was reduced from one age-

-group to the next older one except for those with only primary education where the percentage stayed around 14% in all the older age-groups. Even for those with lower secondary education plus vocational training as many as 19% had low pay in the age-group 20-24. The risk of low pay may be influenced by education and other personal characteristics but it is probably also a problem of economic and industrial organisation.

2. If men and women just leaving the educational system with the same type of education are compared we can assume that differences in personal characteristics are small. Our evidence showed that for all those different types of university education investigated the salaries of women six months after graduation were lower than for men. Only those working full time were included in this comparison.

3. In the longitudinal study standardising for personal characteristics such as education and IQ test scores as much as 90-50% of the variations in logaritmic earnings could not be "explained" by the model. The explanatory power of the model was lower at younger ages than at older.

4. The other analyses relating earnings to supply and demand characteristics showed that such personal characteristics as age and education were more important in explaining earnings differences than region and type of activity. However, the effect of especially branch or type of economic activity was not negligable. Only in the public sector were regional variations practically zero. Labour market conditions apparently differ depending on where the individual worked.

5. The comparison between the private and government sector also pointed to the possible existence of a long term situation of disequilibrium. Differences in earnings were greater in the private than in the public sector among male educational groups and between males and females (standardising for age and education). The 1966-71 period, characterised by excess supply of highly educated but probably no more fierce competition between the private and public sector, brought a reduction in wage differences between men and women (standardising for age and education) and educational groups in both sectors. The rate of change was higher in the private sector but not high enough to erase the sector differences.

6. For a very long period of time (1934-68) rates of return to higher education probably increased. Also great differences have always existed between different types of education at a given educational level.

While for male government employees in 1966 the rate of return to a longer (from compulsory level to higher edu-

cation) and a shorter (from compulsory level to upper secondary level) investment seems to have been the same this was not so in 1971. By then the level of both returns had been lowered but in such a way that the return to a longer investment had become relatively higher than the return to a shorter investment. To this corresponds the fact that the wage ratios in different age-groups were much more reduced comparing the secondary and the compulsory level than comparing higher and secondary education.

7. Within a simple market model an increased supply of highly educated persons would be expected to drive down their wages. As the highly educated become relatively cheaper, employers would substitute them for other factors of production. Also, as the goods and services made with intensive use of highly educated become less expensive to produce a change in the composition of final demand in favour of such goods would be expected. Both these types of adaption would, to a certain extent, counteract the fall in wages for the highly educated. Such mechanisms have certainly been at work and contributed to the changes we observed in wages (reduced wage ratios in the early 70s), in occupations (changes downwards on the occupational profile for the two highest educational groups) and in branches. However, the adaption process often seems to have been rather slow. During the 60s when the output of highly educated grew rapidly, the wage ratios seem to have remained stable for a certain period of time, quantitative instead of price adjustments taking place. When wage-ratios fell, the higher and secondary level were brought closer to the compulsory level while the gap between the university and the secondary level remained about the same.

   The occupational data also showed that the market adaption to excess supply may be reduced average wages for a certain educational group but not so much by reducing wages within occupations as by changing the occupational composition of the educational group. In doing so, the next lower educational group can also be pushed out of its normal occupations. Rationing of jobs would occur at different levels and wages be kept stable in various types of jobs[48] instead of an equalisation of wages received by a certain educational group irrespective of occupation. This kind of behaviour creates a labour market disequilibrium and moreover stifles the adaption on the side of final demand.

8. The information about unemployment rates by education and occupation showed the same type of phenomenon, that is, treatment not according to qualifications but according to position. In manual occupations, the unemployment rates for highly educated were not lower than for those with lower education.

9. The persistent regional differences in unemployment rates can also be an indication of labour market segmentation.

Many factors may of course contribute to the creation and persistence of a situation where rates of return are not equalised and different prices are paid for the same factor of production: the non-existence of competitive forces, institutional and other factors restricting competitive forces, the slow working of competitive forces etc.

Let us discuss a few of these factors that seem to have influenced the Swedish situation.

The educational system

The institutional framework within which the educational system works may have hampered a rapid and efficient adaption to changes on the labour market. Obvious examples of institutional barriers to adaption are compulsory education and education with restricted entry. The high returns to certain types of higher education (e.g. in medicine and dentistry) must at least partly be explained by the restricted entry. The expansion of the "free" faculties was probably also initially held back by restrictions at the secondary level. The possibilities to get round formal entrance qualifications to higher education were introduced rather late. The supply of total numbers of people with different types of education seems, however, by and large to be interpretable as reactions upon market signals though such adaptions have generally been rather slow. Institutional restrictions have operated as barriers in periods of increased demand. A new phenomenon that may cause inefficiencies in the supply of individuals with different types of education in the future is short term overreactions on the part of students in periods of slack demand.

The educational expansion might also have been more rapid if it weren't for the lower participation in certain social groups. The fact that children from social group III, only to a limited extent, go to post-secondary education is, however, not necessarily only related to factors within the educational system. Factors on the labour market as well as the individual's and his family's perception of the value of higher education can also be of importance. If those who experience worse labour market conditions at higher educational levels were more often from social group III this might be of some relevance in this connection. The investigation of those with low pay[47)] does not permit this type of questions to be analysed. We can only note that among women 25 years or more 70% of those with low pay came from social group III compared with 50% among women not having low pay. For men there were no such differences.

Moreover, the differences among social groups as to participation in higher education may lead to inefficiencies as those

best suited for higher education and most able to make a productive contribution once educated might not proceed to higher education. We know that IQ and higher education are far from perfectly correlated. We have earlier seen that the social background of an individual is of great importance for educational achievement. School marks may not do justice to those from lower social groups but even at equal school marks the percentage going to higher education is not the same. Especially at school marks of medium level there were great differences among social groups in this respect. Also, students from lower social groups seem to have less possibilities to utilise reorientation possibilities. Of course little is known about the importance of IQ and IQ plus education for work productivity. In at least some instances, however,[49] education and IQ have been shown to have a positive interaction effect upon earnings. This would thus indicate that the selection process within the educational system is to a certain extent inefficient.

The educational system may also have had other internal inefficiencies as indicated by the negative interaction effect of education and IQ at an early age upon IQ at an older age.

The labour market

On the institutional side on the labour market we have already mentioned the labour unions and the commitment of especially the LO to a reduction of wage differences and increased employment security. The government has also increasingly taken stand in favour of these endeavours. Legislation to increase the security of employment has, for example, been passed. This legislation restricts the scope of action of market forces. Furthermore the whole public sector itself with its rigid salary schedules and seniority provisions is less adaptable to market forces.

As for the supply of labour with different types of education we have just noted that the flexibility has not always been very high. To this can be added the fact that the general mobility on the Swedish labour market has been (and perhaps increasingly so) low compared with the U.S.A. for example. Low mobility and flexibility on the side of supply would, of course, tend to create non-competitive results on the labour market. The behaviour of private firms and other producing units can, besides the behaviour of supply and institutional factors on the labour market, be more or less conductive to the persistence of a segmented labour market with different conditions ruling for the same type of factor of production.[50]

Long run efficiency considerations in cases of a stochastic supply of labour, continuous and substantial amounts of on-the-job training may lead the organisations to practice a certain rationing of job . Preferences on part of clients and employ-

ees in favour of discrimination may have the same effects. In situations with uncertainty, information and search costs may prevent factor price equalisation. Transaction and mobility costs have the same effects. Owners and managers of production might also have an interest in order to retain or increase control over the production process to organise work hierarchically. The wage structure, the number of hierarchical levels and of jobs at different levels could be arranged with that purpose in mind. In these situations labour market segmentation is not necessarily created for lack of competitive forces but for efficiency and control purposes as seen by managers of production and owners of firms.

In other situations, segmentation could be caused by the lack of competitive forces or the slow working of competitive forces on the demand side of the labour market. Discrimination based simply on prejudice and low mobility of capital would be examples of this.

Segmentation of the labour market can create not only different conditions within educational groups but also differences between educational groups on top of those that would have existed in a competitive market. Differences between educational groups will be further discussed in the next section.

The share of employment in the service sector and in white collar occupations has increased. The educational supply was more in line with the structural changes of branches than with the structural changes of occupations which could be expressed as the latter having changed more slowly than the former. The rationalisation and concentration process may have contributed to this. The public sector and bigger companies have come to play a more important role for employment. Certain tendencies towards the creation of internal labour markets have also been noted. These tendencies and the declining importance of small firms may have led to a more highly structured labour market. The changing composition of final demand and technical development possibly calling for more on-the-job training certainly influenced this development. How exactly all these factors are to be related to the organisation of work within various types of organisations and this in turn to the demand for labour with different types of qualifications and the way this demand expresses itself we know less about.

In many cases it would be possible to interpret our data in terms of a simple competitive model though adaptions to new conditions seem to be very slow. However, a closer investigation of the mechanisms or changing mechanisms behind such results would be instructive. For example, the recent reduction in wage ratios for the highly educated following a period of increased supply may not, or only still later, have come about if it were not for the commitment of the government and the larger labour unions to income equalisation. Certain tendencies on the labour market would seem to

guarantee other forces than regular market forces a greater influence on the future development: the growing size of the public sector, the general interest in income equalisation, legislation to secure employment, the growing size of firms etc. The effects of these institutional changes upon the labour market should be further investigated. They could in the future be results less, rather than more, readibly interpretable as "competitive" results.

Some of our data also indicate the existence of segmentation and of non-competitive results on the labour market. The male-female differences would be one example. The occupational data also seem to warrant a closer investigation into the behaviour of organisations. The development of the occupational structure seems to have followed the same pattern in many countries being more related to economic development than to e.g. educational supply. Moreover, when people with higher education are in excess supply some seem to continue to get the same types of job and the same pay as before. Others get simpler jobs and are less paid. In this way average wages may be lowered but hierarchies kept. The treatment of the individual (wage, risk of unemployment, on-the-job training, advancement possibilities) may go more with the job he manages to get than with his capacities.

5.2.2 The role of education

Having discussed some general features characterising the Swedish labour market let us now pursue the analysis of education and earnings. This discussion will center around the more direct relationship between education and earnings as we have not material enough to tackle the indirect effects via changes in attitudes and institutions. - Whether or not institutional factors and other barriers to mobility give rise to different labour market conditions for a given educational category what lies behind these demand curves and why are on the average earnings higher for highly educated?

Already for <u>a priori</u> reasons it would appear highly remarkable if the same type of mechanism were at all times and for all types of education to explain the association between education and earnings. The material we have presented earlier in this report seems to warrant the search for an explanation from three starting points:

- education as a search and information process
- education as a human capital investment
- education as sorting

We will concentrate our discussion on the two latter types of approaches and one-dimensional versions of them. The relative

merits of the first approach will not be further explored here. We can just note that we earlier saw that certain Swedish investigations pointed to the possibilities of this type of effects being important. We can also refer to studies made in the U.S.A.[51] that show the importance of education for labour market information and of the latter for earnings. A regression analysis showed, for example, that labour market information among young men was correlated with length of education and social background, though not with the amount of vocational guidance. Labour market information in turn was correlated with earnings a few years later.

Now, before we can start discussing whether our data may be better interpreted as supporting a human capital or a sorting approach we must make clear what exactly is to be understood by either approach. Different interpretations of them are possible and give rise to different implications to be tested.[52]

Let us start by presenting a rather simplistic version of the human capital model. Basic to the human capital approach to wage differentials is the compensation principle. Human capital is acquired at a cost. If firms want to hire individuals with higher education they have to pay a wage differential high enough to compensate for the costs involved in obtaining higher education. Other types of human capital investments, e.g. on-the-job training, would also enter into the determination of wage differentials. In a perfectly competitive market in equilibrium the marginal rate of return to every type of investment and for every individual would be the same.

Actually what is acquired, e.g. skills or attitudes, by the individual as human capital equipment is, of no great importance to the human capital approach. However, much of the interest has centered around cognitive abilities and additions to the stock of knowledge.

With this approach we would expect individuals leaving the educational system after a shorter period of time to have lower earnings (1 in figure 5a). The individual pursueing education for a longer period of time has no earnings and perhaps some extra costs to begin with. Later his earnings will be higher (2 in figure 5a) so much higher as to compensate for the earnings foregone and the extra costs during education. Both individuals may, however, undertake investments after leaving the educational system (e.g. on-the-job training). This investment will also cost something, thus lowering earnings, but later yield a return, thus increasing earnings, as illustrated if 1b and 2b are compared with 1a and 2a respectively in figure 5b. In equilibrium the lifetime earnings implied by all these curves (1a and b, 2a and b) would be the same. Investment incentives could be expected to be reduced as the individual gets older. Thus including returns to on-the-job training we would expect the earnings profile to rise but at a

decreasing rate. An often used functional form to test the human capital hypothesis is:[52]

$$\ell nYt_i = a + bS_i + cF_i + dF^2_i + v$$

where:

i = individual i

ℓnY_t = logarithmic value of income in year t

S = years of education

F = years of labour market experience

v = error term

a, b, c, d = constants

If we make the specific, but somewhat arbitrary, assumption that individuals devote the same share of earnings to human capital investments once on the labour market and this share later decreases at the same rate those with higher education would show faster growing earnings profiles than those with shorter education (figure 5c). At first the wage differences between educational groups may get smaller but later they would continually grow. If we compare individuals with the same type of education we would expect those having lower earnings early in life (= making large investments) to have higher earnings later.

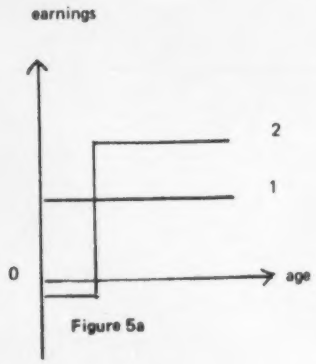


Figure 5a

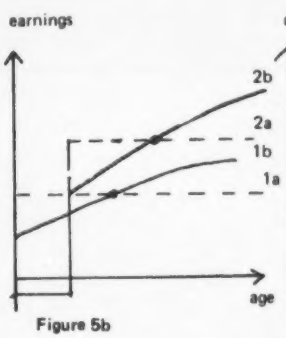


Figure 5b

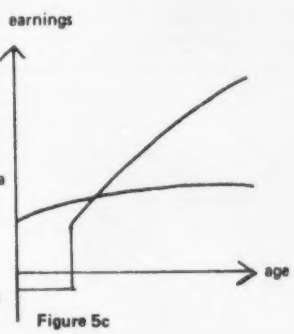


Figure 5c

With the existence of on-the-job training we could only obtain information about the differences in earnings caused by education alone by comparing individuals that have been out on the labour market a certain number of years. (In figure 5b by comparing the earnings at the intersection of curve 2b and 2a with those at the intersection of curve 1b and 1a. These intersections have been called the overtaking point.) Earnings of individuals after approximately 10 years on the labour market have sometimes been used to see whether they could reasonably be explained by differences in schooling period.

It might be of interest to see how far these implications of a certain simple human capital model can be reconciled with our data. However, let us just at once point out a number of factors that might be added to the model and should be kept in mind when interpreting data.[53] The above mentioned implications have not taken into consideration e.g.:

- innate productive capacity, depreciation of human capital, non-pecunary aspects of jobs and education as a consumption good
- child rearing, household production and other non--market activities
- uncertainty, lack of information
- human capital investments paid for by others (e.g. parents, employers) or human capital accumulation paid by no one (e.g. incidental learning by doing, biological maturing)
- individual variations in preferences, access to information, possession of innate productive capacity, ability to profit from education and on-the-job training, opportunity to finance human capital investments etc.

Ideally one should test the model on as homogeneous groups as possible with reference to the above mentioned individual factors.

The implications are also supposed to hold only in equilibrium situations. In disequilibrium situations the human capital model only indicates the direction of change. An increased demand for educated people would e.g. at first be expected to raise their wages. The wage increase would be mitigated to the extent that there exist substitution possibilities (i.e. possibilities to replace this production factor by other now relatively cheaper factors of production). Later the wage increase would be expected to bring forth a greater supply lowering wages until a new equilibrium position is reached. In the same way an increased supply of educated people would first tend to lower wages and later to reduce the supply until equilibrium is restored.

Within this type of human capital model a rental price for human capital would be established that equalises total demand for and supply of human capital services. The resulting income structure would be determined by the distribution of human capital and the latter by individual differences in human capital production and tastes. No special requirements for certain types of income hierarchies would be expected to come from firms and other organisers of production.

As for the sorting hypothesis let us sketch a few versions:

Longer education or better school marks could be treated by employers as an indication of the possession by the individual of favourable characteristics. The individual would get at least a first job in correspondence with the length of education

and/or school marks. What would happen later to the individual, whether education would work as a permanent or only a temporary screen would depend on the employer's interest in and possibilities to discover what the suitability and the real capacities of the individual are. If the follow-up is strict any unwarranted sorting effect of education would be of rather short duration suitable individuals advancing faster whatever level they start at. In this case the correlation between education and the individual's position could be expected to decrease over time and the correlation between position and suitability or capacity (possibly IQ) to increase. For a given educational level the correlation between "suitability" and position would increase over time and for a given level of "suitability" the correlation between position and education decrease.

If the employer's interest in and possibilities to follow the individual's performance were small the correlation between education and earnings could be expected to remain stable over time.

Finishing an education of 4 years and obtaining a certificate could also be expected to give a greater return than expected by the additional effect of extra educational years as measured by the three first years. Earnings may also be expected to be more highly correlated with traditional educational levels than with educational years.

With a permanent screen the development over time may look like the one in figure 6a and with only a temporary screen like the one in figure 6b.

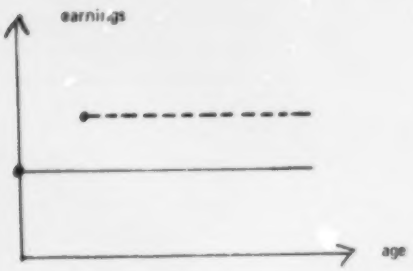


Figure 6a

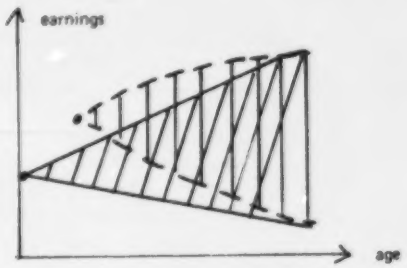


Figure 6b

Sorting hypotheses do not necessarily have to be combined with a complete denial of every investment element in education nor with the absence of on-the-job training and post-school investments. The sorting function of education may instead precisely have a bearing upon not only who gets a good job but also on who gets a good job with development and on-the-job training possibilities. Certain jobs may be richer in this respect than others. For different reasons

by-product of the organisation of work, at the same time as the value to the firm of this training is high and much higher than to the individuals, competitive forces may be prevented from driving down wages in these occupations. Those who get into jobs with large development possibilities will see their capacities and earnings increase. Human capital construction occurs but not necessarily at a cost for the individual. Other individuals get into jobs with less development possibilities perhaps even jobs where human capital destruction results. In this situation productive capacity and earnings will also be related but for different reasons than in the human capital model. If a criterion for assigning individuals to these different types of jobs were education increasing differences between educational groups over time would be expected as in the human capital model. However, at a given educational level there would be no special reason to expect those who start low to surpass the others later.

A reason why employers might use education as a criterion for choice of individuals for the more promising jobs could be that they are of the opinion that on the average highly educated people are socially better suited for jobs in leading positions and can adapt more quickly and at less costs. This opinion may have been born out by previous experience and we get what is called statistical discrimination. It may also be based on tradition and conventions without any verification as to efficiency. Educational merits can furthermore have the advantage of being accepted by large groups as a fair criterion for choice.

With a sorting approach factors other than education would be expected to play an important role in determining the occupational and resulting income structure in firms and the economy in general. From an educational point of view the occupational structure could to a large extent be taken as given being designed to assure a controlable and smooth organisation of the productive process.

A common argument against different types of sorting hypotheses might as well be dealt with at once. It has been maintained that if education only sorted private test agencies would be set up as they could do the same thing much quicker and cheaper. In Sweden no such development has taken place. The lack of test institutes might indicate that education is something else than pure testing.

Let us now try to relate our data to these different types of hypotheses:

1. An analysis of earning profiles

   First a word about the possibilities to use cross-sectional data to test the human capital model that actually predicts what would happen to the earnings of an individual over his lifetime. An individual can be

seen as advancing over time from one cross-sectional curve to another (figure 7). The increase in earnings that results (e.g. F to G) can be separated into a movement along the original cross-sectional curve (F to H) and a jump to a higher curve (H to G). If this second step always produces a parallel shift in the cross-sectional curve that is the same for all educational groups we could, for all practical purposes, disregard it as not influencing decisions about education. Certain evidence shows that at least for certain higher educational groups the percentage shifts have been about the same.[54] However, in absolute terms and for all educational groups they have probably not been identical which is a fact that is not taken into consideration below.

The general shape of the age-earnings profiles coincides with what would be expected from the human capital approach presented above: a positive but declining rate of growth of earnings. In some instances, however, a depreciation factor would have to be introduced that actually lowers earnings at older ages, such as

- in 1971 (all employed) for the lowest educational groups
- in 1971 (government male employees) for higher education and certain types of upper secondary education.

The age-earnings profiles for different educational groups seldom cross which means that higher educational groups get higher starting salaries than the earnings of lower educational groups that have been out on the labour market a certain number of years. The curves for higher educational groups especially for those with university education also increase faster than for lower educational groups. The latter fact would, with a human capital approach, be interpreted as the effect of greater on-the-job investments. The costs to these groups for this investment is not to be seen in a comparison with other educational groups but with the salaries they would have obtained if they did not do any on-the-job investments. We will return to this question below.

Now, why should there be a positive correlation between length of schooling and amount of on-the-job investment? Introducing an ability factor an explanation within the human capital model could run as follows: some people are more able than others. This ability permits them to get more out of education than other individuals. They therefore find it profitable to take a longer education (more investments are possible until the marginal return is driven down to the minimum required). Those talented for education would also be more gifted for on-the-job

investments thus being induced also to undertake more post-school investments.

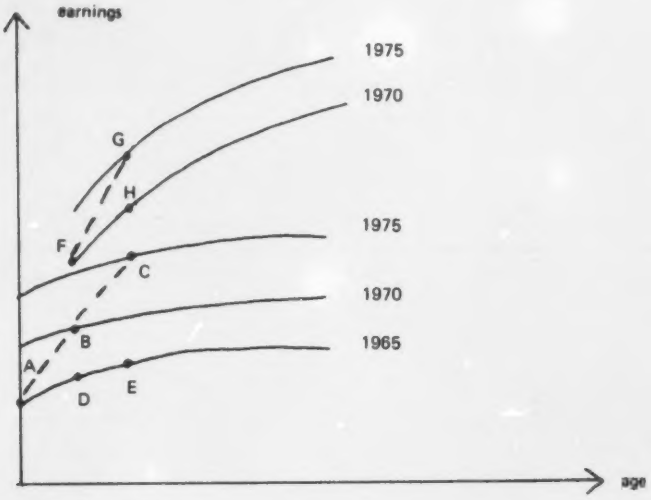


Figure 7

Ability differences of the kind just discussed may be a conceivable explanation of the different shape of earnings profiles at different educational levels. However, at equal educational levels the earning profiles of women rise less rapidly than those of men. You might argue that men and women, who have, for example, finished higher education, are as able to profit from education but women less so from on-the-job investments. Therefore they undertake less post-school investments. However, this does not show up in women with a university education having higher earnings the first years after graduation, on the contrary.

The only exception to women with a university education having lower initial salaries than men with the same education was for government employees with a medical education.[56] In this case, the interpretation could thus be that women take jobs that pay well but have few training possibilities which results in a flat age-earnings profile. Men pay for their more sharply increasing earning profile by accepting lower starting salaries. However, training should, in this case, be understood in a very wide sense including gaining commercial skills as women seem to take jobs where the possibilities to develop medical skills are as important.

Other evidence points in the same direction, normally not those with low starting salaries at a given educational level have the highest earnings later on. Among male university graduates, working full time with low,

medium and high earnings 6 months after graduation (1972) 13%, 44% and 93% respectively had high earnings three years later.[57]

Certain investigations include some approximate measure of on-the-job training. At lower educational levels the percentage taking jobs especially indicated as giving practical experience was investigated in 1973. This investigation showed, as we have mentioned earlier, that the percentage with such jobs was higher among those with a comprehensive than with a upper secondary education and at each level among women than among men. In none of our materials has there been any sign of these groups, with eventually more "on-the-job training", having faster increases in earnings. To get more precise information it would, of course, have been preferable if these 1973 groups themselves could have been followed up.

Data from 1974 contain information about earnings and the percentage indicating that they have great possibilities to learn new things in their jobs by education, age and sex.[62] This percentage was higher in each age group at higher educational levels but always lower for women than for men. Within each educational category the percentage declined with age. However, a comparison between men and women shows that initial earnings are not, as might be expected by a human capital approach, higher at equal educational level for groups with less training possibilities.

With a sorting approach these differences in age-earnings profiles could be interpreted in terms of some people getting into jobs with promotion possibilities while some do not. Some people have the ability to utilise these promotion possibilities others do not. Education can be one of the factors determining what type of job people get and their possibilities to profit from given opportunities but not the only one as the male-female differences at given educational levels would tend to show. In contrast with the human capital approach the faster increase in earnings would not be interpreted as returns to investments on the job paid by the individual.

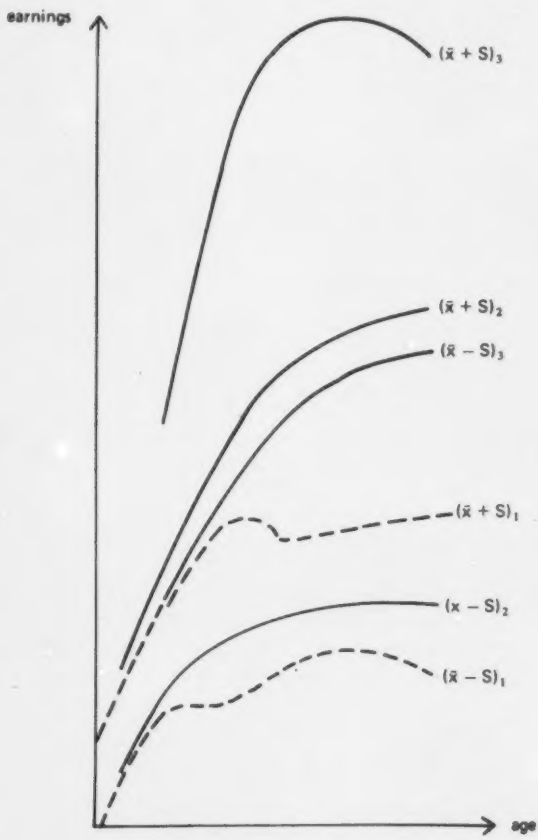
2. Variance around age-earnings profiles

With the human capital approach differences in earnings between educational groups could be expected to be U-shaped over age, first decrease slightly and then increase. This does not fit in very well with our data especially not those from 1934. There the differences were greatest in young age-groups and later decreased. In 1971 (all employed) they first increased and later decreased. Higher education might have had more of a sorting function in the 1930s than later working as a permanent screen protecting those with higher education but with the possibility for capable individuals, at lower educational levels, to advance.

As for the development within an educational group, only with a permanent screening hypothesis, would we expect the variance not to increase over age. This, however, happened in the 1966 data (males) especially for the highest educational group. The material from 1971 for male government employees showed, as we have already pointed out, more diverse tendencies. Both the standard deviation and the standard deviation as a percentage of the average salary first increased and later decreased in the highest educational group, continually increased in the intermediate educational group and first decreased, later increased, and finally decreased again in the lowest educational group.[58]

Assuming that the earnings within educational groups, at different ages, was lognormally distributed the overlap in earnings for different educational groups was calculated on the 1971 male government material.[58] Figure 8 shows the variation in earnings in different educational groups

Figure 8



(3 higher, 2 intermediate, 1 comprehensive education) as measured by average earnings $\pm$ the standard deviation in each educational group. While 85% of those in the highest educational group was calculated to have earnings higher than $(\bar{x}\text{-}S)_3$ the figure varied over age approximately from 15% to 30% to 20% in the intermediate and from 9% to 20% to 0% in the lowest educational group. Earnings less than $(\bar{x}+S)_1$ had 85% at the lowest educational level. The figure varied over age approximately from 80% to 70% to 40% in the intermediate educational group and from 8% to 15% to 1% in the highest educational group.

While there is a large overlap in earnings for the two lowest educational groups the chances of people with such education to get over $(\bar{x}\text{-}S)_3$ are rather small. These findings are reconcilable with the human capital approach assuming that people at lower educational levels could at a sacrifice in earnings take jobs with large training possibilities bringing them up to the higher income levels but that they generally lack the incentives to do so.

3. According to the human capital model the effect upon earnings of educational investments alone could be studied when the individuals had been out on the labour market a certain number of years at the so called overtaking point (see figure 5b). The earnings of male governments employees have been analysed along these lines.[59] The overtaking point was assumed to occur after alternatively 6, 8, 10 and 12 years of labour market experience.

The formula (using the same symbols as earlier):

$\ell n\, Y_i = a + bS_i + v$ was tested.

The results were very good in the sense that the correlation coefficient (R^2) was high (0.94-0.93). They also indicate that the rate of return on investments in educational years above compulsory schooling was 8%. Analysing the situation for different types of education certain divergences were found to exist. The earnings at the overtaking point were higher than might be expected given the number of years of education for physicians, dentists and economists and lower than expected for upper secondary economists, social workers and theologians. In the former case the divergence could be explained by restricted entry and in the latter perhaps interpreted as a situation of disequilibrium or the effects of non-pecunary aspects.

It may also be interesting to note that the rates of return for the different types of education over the whole working life were positively correlated with

higher or lower than expected earnings at the overtaking point. [59]

As we saw above the results concerning the pure effect of educational investment as studied at the overtaking point were not much influenced whether the overtaking point was set at 6 or 12 years of labour market experience. This stability in results rather naturally leads to the question: what would have happened if the regression was run on wages obtained immediately after graduation i.e. at 0 years of labour market experience. If these were as highly correlated with education you might start wondering if the higher educational groups ever pay for their faster increases in earnings. Unfortunately this question was not raised in the study. Inspection of the data published gives, however, the impression that the same type of correlation might have been obtained even in this case.

4. As for the question whether the returns to education are more tied to obtaining a special certificate or the amount learnt the following facts could be recalled:

   - Education as measured by educational level was more highly correlated with earnings than education measured by number of years. It was also more highly correlated with social background and early IQ.
   - The more prestigious academic Higher Leaving Certificate gave a higher return to education than other upper-secondary types of education.

   Unfortunately, we have no Swedish data for earnings of drop-outs as compared with people finishing a given education.

5. An important factor for how to interpret earnings data is individual capacity. If we could measure individual capacity we would directly know whether education increased individual productive capacity or if it only sorted individuals and if the sorting was done according to productive capacity. However, it is difficult to know what exactly should be meant by individual capacity, if such a one-dimensional thing exists and how it should be measured. The only information we have concerns the relations between variables such as social background, IQ, education and earnings. Unfortunately, not much is known about these variables either as all information comes from different analysis of one and the same material (i.e. the follow up of the Malmö sample).

   According to the path-analysis social background and IQ-test at an early age (themselves not highly intercorrelated) influence education (explaining 40-50% of the variance) but not directly occupations and earnings.

Education influences earnings and increasingly so over age. About half of the total effects of education upon earnings goes via occupation obtained. With education measured by educational level the direct effects of education on earnings are somewhat stronger than with education as measured by educational years. The effects of IQ-test scores measured later in life are also different depending on what educational variable is used. When education is measured by educational level IQ has no significant effect at any age. When education is measured by years IQ influences earnings and increasingly so over time. Interaction effects were also somewhat different. While in both instances a positive interaction effect between occupation and IQ upon earnings was found education and occupation only interacted upon earnings in case of education measured by years. No significant interaction effect of education and IQ upon earnings was found. In other analyses not considering occupation and interactions at that level a positive interaction effect upon earnings of education and IQ[49)] or alternatively of high IQ and social background in combination with education has been found.

This material is, as we have already discussed, suggestive of both educational sorting and investment effects. The former could be connected with the indirect effects of education on earnings via occupation obtained. However, as both general and vocational training effects of education are involved the indirect effects via occupation are difficult to interpret. Moreover, the occupational categories were not constructed especially to analyse possible sorting processes. Also, the direct effects of education could contain both sorting and investment elements. In our opinion this information does not permit any firm conclusions to be drawn as to the underlying mechanisms that for this group of men connected education to earnings.

6. From the retrospective study of persons in leading positions two observations could be retained:

   a) For those working in the private sector the occupational level first attained was associated with educational level. Those with a shorter education that later advanced to leading positions had more often begun their careers in small enterprises. This might indicate that with a greater dominance of big companies the labour market may become more highly structured and alternative career paths might tend to disappear.

   b) The comparison between the co-operative and the private sector showed that careers can be organised in different ways. In the co-operative sector people in leading positions had often started

at low occupational levels and later advanced as they took advantage of in-service-training.

7. With more disaggregated data other types of interesting comparisons could be made. It might, for example, be instructive to study:

   - whether the simple human capital earnings function presented above better describes the situation for certain parts of the labour market than for others. In an American study[60] this was found to be the case. Cross-sectional earnings data for occupations at higher hierarchical levels fitted the human capital earnings function better than cross-sectional data for jobs at lower hierarchical levels or on the dual labour market. What is the mobility between these segments?
   - more in detail what worker traits are rewarded with higher pay, training possibilities and advancement? Can they be related to education?
   - at each educational level what are the training alternatives? To what extent can the jobs individuals do or have been able to choose at a given educational level be said to contain more or less opportunities for acquiring skills or worker traits rewarded by employers? Inspection of figure 9 (based on German data)[61] seems to suggest that for those with higher education there might be more of a choice. As self employed they seem to be able to undertake great human capital investments. For other educational groups there is not the same difference being self employed and not. In the Swedish data from 1974 the percentage indicating that they had great possibilities to learn new things in their jobs was also lower in lower educational groups.

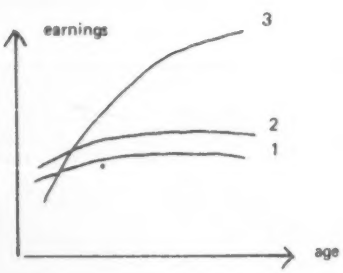


Figure 9a

Self employed

3 higher, 2 secondary, 1 primary education

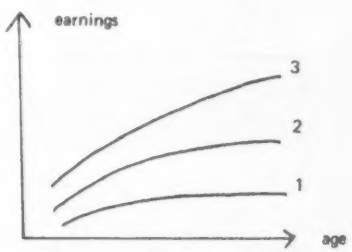


Figure 9b

Others

- what things learned and what type of labour market experience is of value? In one instance we saw, for example, that at the comprehensive level the risk of unemployment did not decrease with the length of labour market experience.

- whether education can be said to give rise to different effects for those types of jobs where individual performance is more difficult or costly to observe than for other types of job.

- the wages obtained by individuals with a certain type of education who go to jobs corresponding to their educational specialisation and those obtained by individuals who go to other types of jobs. This would be of interest to be able to analyse the cognitive version of the human capital model. If individuals gain the same returns to education in both situations this would indicate that, if education is to be regarded as an investment, it would have to be for other reasons than adding to the stock of direct vocational skills. Of course, there are many problems involved in making such investigations such as how to determine what occupations correspond to a certain education. For Sweden, we only know that even in vocationally oriented education an important number of students seems to get jobs not related to their education. We know less about wage differences in these cases. In certain cases they seem to have been lower in occupations less related to the educational orientation.

5.2.3 Provisional conclusions

As will be clear from the previous discussions we are not in a position to draw any firm conclusions as to the mechanisms by which education and other economic variables have been related and how they interact. A forteriori a rigorous evaluation of the educational system and the educational policy from efficiency and distributional points of view must wait.

Both sorting and investment elements do seem to have been and to be involved in education corresponding to a less than perfectly competitive labour market. In the labour market differences have remained even over time between regions, men and women, the private and public sectors, and possibly within educational groups between those get into good and stable jobs or careers and those who do not. However, given this type of segmentation market signals are at work and seem to have influenced the supply of different types of education and wage ratios. Market adjustments seem, however, to be rather slow and both on the supply and the demand side hampered by different institutional arrangements, traditions and other than effici-

ency considerations. The low level of unemployment, the active labour market policy and the fact that the Swedish government mainly used general instead of selective means in its attempts to achieve full employment has, however, probably to a great extent, counteracted segmentation tendencies. The increasing elements of regulations and selective policy measures may work in the opposite direction as well as the growth of the public sector and big companies with internal labour markets.

Our information about the relations between education, occupations and earnings before or at the early beginning of the educational expansion, is rather scanty. In those days vocational training for occupations at lower occupational levels took, to a great extent, place outside the formal educational system. A limited number of individuals were able to continue formal education to the university level. The higher educational system provided vocational training for teachers, lawyers, engineers, physicians, dentists etc. The selection operated by the educational system may have been more highly associated with social background than with educational or productive capacity or IQ.

It is quite possible that a rather pure cognitive human capital approach to the development of earnings and on-the-job training might be applicable at lower educational levels for this period. Most people left the educational system at these levels and many different types of jobs combining work and on-the-job training in various proportions stood open. A lower rate of technical and other changes also created less uncertainty about jobs and job perspectives for workers. At the same time the need felt by employers for any initial sorting might have been small as productive capacity probably was rather easily observable and recruitment mistakes could be corrected at low costs. Higher education, while providing opportunities for human capital formation, probably created monopoly rents and had selective effects permitting individuals to get into more advantageous careers than warranted by their productive capacities.

The development has changed this situation. By now the formal educational system carters for a great deal of the vocational training already at lower occupational levels. For those who only get comprehensive education and thus do not participate in the formal vocational education the labour market situation can be quite difficult. There are fewer alternatives and possibilities for skill formation left for them on the labour market. They risk never getting into the primary labour market.

With the expansion of the upper secondary level and its diversification in connection with the integration of vocational education a new element might be said to have been introduced at this educational level: occupational choice. Earlier this took, for most people place, on the labour market. Now,

the educational system has to cope with this activity. The educational system might not, at least not initially, have been especially well fitted for fulfilling these tasks efficiently. There are two sides to this problem. One is how to adapt the types and numbers of courses within occupational fields. Here, the drawback of the educational system is its remoteness from the labour market. The other is how to help individuals to choose and how to select individuals among those applying, when there are more applicants than places available. Here, the educational system might be expected to give priority to its own criteria (e.g. educational suitability), which might be something quite different from productive capacity within a certain occupational field.

Many more individuals nowadays continue to higher educational levels. The selection of these individuals may have become somewhat more correlated with educational capacity and somewhat less with social background than earlier. At this level too the tendencies towards integration and diversification have been felt. After a period of loosening ties between higher education and occupations efforts have been made to strengthen them as both the volume of shorter and longer more directly vocationally oriented courses has been increased and education at the "free faculties" has been given a more vocational orientation.

This diversification and specialisation creates uncertainty and information problems, especially during periods of rapid structural change on the labour market. The students may be uncertain about their possibilities to fulfil the educational requirements of a certain type of education and about the labour market perspectives within a particular vocational field. This uncertainty would tend to reduce the possibilities of rapid and efficient adaption of supply.

At the same time employers may, for different reasons, have become more interested in using educational merits as at least an initial sorting devise. Sorting after general ability (not specific vocational training) may be valuable with a rapid rate of technical change, more on-the-job training and legislation creating rigidities and increasing the costs of lay offs. The expanding public sector and the big companies may also use a more formal recruitment policy and for organisational and other reasons rely on educational credentials.

The greater amount of diversification, specialisation, change and uncertainty may thus have reduced the scope for a simple human capital approach relying on perfect markets as both the number and length of disequilibrium situations may be expected to have increased and as education may more often be used as a general capacity signal. However, it is possible that at the same time the educational-occupational sorting of a more social character has lost some of its importance.

Within a segmented labour market the chances of education having sorting effects would seem to be greater. However, the investment type of effects of education increasing skills and capacities of individuals would not necessarily be smaller in a segmented than in a competitive labour market. The problem is rather how to identify these effects in a segmented market when earnings are more loosely related to the productive capacity of individuals. The simple human capital model could turn out to be less applicable in such a situation not for the reason that education does not improve the skills of individuals but for the reason that no common rental price for human capital services is established and the returns to educational investments are not equalised. To gain a better understanding of the effects of education given the structure of the Swedish labour market and current development tendencies we think it necessary to conduct more detailed studies of the effects of education at the level of individuals and firms (see below micro level studies). At the same time the mechanisms behind the operations of the labour market, whether the results be interpretable within a competitive model or not, would merit a closer follow-up (see below intermediate level studies).

To the extent education has sorting effects more information is also needed if we were to evaluate these effects. We would have to know what sorting criteria are used. Are they relevant from the point of view of efficiency in production? Furthermore we must ask whether or not the same sorting could be achieved at smaller costs. In the same way for an evaluation of education as a human capital investment we need more precise information about what the social returns to educational resources alone are for different types of educations and individuals to be able to compare it with the returns yielded if the resources had been used for other purposes.

To evaluate the distributional effects of the educational system we need a better understanding of the factors influencing the individuals' participation in education, the organisation of work, hierarchical structures and job content.

5.3 Educational research and future educational planning

There can be many reasons why policy objectives are not reached. Educational research, may in some instances and on certain conditions, be helpful. A first requirement would seem to be that the collection of statistics is geared towards the fields of interest. In this report we have on several occasions noted that unfortunately little is known about what is going on, if the objectives are being approached or not.

The existence of relevant data permits an investigation of relations between variables. However, gathering and analysing

data will never be enough if you want to base educational policy on a firm ground. Explanatory models are needed if you are to understand the existence or non-existence of relations between variables and mechanisms working beneath the surface.

With a theoretical understandning of the workings of education, a discussion of effects of educational policy becomes meaningful. Means can be related to goals. A better theoretical understanding can also permit a more precise formulation of goals. This need will probably also be felt more strongly in the future. Earlier, when the level of educational activity was low, educational expansion almost irrespective of what type could be recommended both for efficiency and distributional reasons. Now that further educational expansion is less self evident a more difficult balance between different types of actions will have to be struck. Decisions more marginal in character will have to be taken and need a more precise view of education.

Theory will also be useful when educational policy is to be coordinated with that of other sectors for reasons of consistency and efficiency. One might ask whether education is a reasonable and possible means to affect earnings.

Certain conditions should, however, be fulfilled by theory:

- It should aim at being all-inclusive. Different approaches should rather be integrated than each tried to see how far it carries one, leaving the rest in the dark. This probably implies that simple relations have to be abandoned.
- It should cover all the levels and areas that educational policy has aimed at. In the case of Sweden this would include both long run institutional effects and medium and short run efficiency and distributional effects.
- It should be precisely stated and thus ameanable to discriminating tests.

Theory at the following interdependent levels would thus be needed:

1. Micro level. Given the educational system and society at large how do individuals and firms behave? What are the effects of education upon individuals and what difference do these effects make in production?

   How do firms determine their occupational structure? What are the important considerations when organisational changes are introduced and new people are hired?

2. Intermediate level. How do markets behave? What

factors govern the supply and demand for different educational categories? Are changes in the structure of relative prices for educational groups related to changes in demand and supply and if so by what mechanisms? Decentralised decisions by individuals and firms? Decisions at more centralised levels?

3. Macro level. How is institutional and technical change taking place and what does institutional change and technical development mean for the functioning of markets, individuals and work organisations?

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Abbreviations

AMS	National Labour Market Board
OECD	Organisation for Economic Co-operation and Development
Prop	Government bill
SCB	National Central Bureau of Statistics
SI	Federation of Swedish Industries
SM	Statistical Reports
SOFI	Social Research Institute
SOS	Official Statistics of Sweden
SOU	Official investigation
Sthlm	Stockholm
UKÄ	Office of the Chancellor of the Swedish Universities

III

Bengt-Christer Ysander

HOMOGENEITY IN EDUCATION

A comment on the economic theories of education

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Introduction

During the first quarter century after W.W. II, most Western countries experienced rapid expansion of their educational systems, especially marked in higher education. This expansion was often supported by widely held optimistic assessments of the potential benefits of increased education in promoting economic growth and also in contributing towards an equalization of incomes. The human capital approach, developed during the same period by Chicago economists, provided a way of more strictly formulating the basis for these assessments and of incorporating the educational system into the main body of economic theory. Its conceptual framework made it possible - or so one hoped - to derive testable statements about the impact of education on productivity and growth and about the way the spoils of this growth were divided between individuals and between functional and educational categories.

In the last few years retarded economic growth in many countries has seemingly put a brake on both demand for higher education and the flow of tax-money available for educational expansion. At the same time the mood seems to have changed among both decision-makers and analysts. In discussions on educational policy, in West-european countries at least, one is now less apt to take the economic benefits of increased education for granted and more concerned with the qualitative direction of the educational system.

More than ever before there is an acute need for answers to the central questions about the economic role of education - what does education do to people, what do educated people do to production and what do they get out of it? So far economic analysis does not seem to have provided any clear-cut and wholly convincing answers in spite of the quite considerable empirical research work carried on during the last decades and the increasingly sophisticated refinements of human capital theories. The outcomes of attempts to measure the contribution of human capital to economic growth are still highly divergent and the methods very controversial. The distributional implications of the human capital theory have also been confronted with various kinds of empirical evidence especially in the form of estimated rates of return to educational investments. The results presented so far seem inconclusive and difficult to evaluate. While a considerable, sometimes major, part of income differentials can often be accounted for by educational differences, the existence in some countries of large divergences in the rates of return on different kinds of education and the unexpected degree of permanence in absolute and relative levels of these rates, even

during periods of rapid educational expansion, seems harder to accommodate at least within the simpler versions of human capital theory.

There are also rival ways of interpreting the evidence. One such alternative interpretation that has lately attracted a good deal of attention views education mainly as a filtering device, whose main function is to measure and certify the given inherited ability of the students. That this interpretation cannot be just rejected as obviously conflicting with the given evidence is shown by the continuing laborious search - so far not very successful - for discriminating empirical tests to be used for choosing between the alternative theories. Since the policy-implications of the alternatives are in many ways radically different, this is certainly not a very reassuring state of affairs for the policy-makers.

At the same time developments in economic theory, especially the incorporation of uncertainty in general equilibrium theory and the outcome of the so called "capital controversy" in capital theory, seem to accentuate the need for a basic reassessment of the economic theories of education and a search for new approaches.

The aim of this paper is to make a modest contribution towards such a reassessment by focusing attention on one particular assumption in the current economic theories of education. This is the assumption of homogeneity - homogeneity of people and homogeneity of education - which we consider to be of strategic and pivotal importance in giving direction to educational analysis and research as well as to educational policy.

1 The one-dimensional man of economic theory

In general economic theory man appears in two very different roles. As consumer, property owner, manager and organizer the individual is treated as a very distinct personality set apart from his fellow beings by his own characteristic tastes and endowments of wealth and talent. Considered as a factor of production on the other hand he is usually reduced to an anonymous labor unit, whose hourly effort is indistinguishable from that of his fellow workers. The interest in economic theories of production and investment has traditionally been centered on real capital, which by being heterogeneous and immobile, supposedly defines the productive capacity of the firm or the economy. In contrast to this, labor - when defined as homogeneous, mobile and in given supply - is simply an amorphous commodity to be utilized within the chosen production technique. It regains an independent role only when attention is shifted from production theory to the theory of employment and capacity utilization.

This tradition of treating labor as a homogeneous factor of production goes back to the classical economists, for whom homogeneous labor units also provided a "measuring rod" for economic values. Abstracting from individual characteristics may also have involved less risks for misrepresenting the economic realities in the early industrial period when production in factories was organized simply, utilized mostly manual skills, and dealt with unorganized labor in abundant supply.

With the successive increase in the relative scope and complexity of the "control sphere" of production and in the amount of specialized education and on-the-job-training involved, the assumption of homogeneous labor becomes much more difficult to defend. As increasingly more heed is paid to the vested interests of different groups in the labor market and the aims of social security are widening to include security of work of a certain type in a certain place, the assumption of mobile labor also becomes more controversial.

The tendency among economists to fall back on an assumption of homogeneous labor is not just an historical accident or due to analytical laziness. Instead it depends on certain

inherent characteristics and limitations of the economic approach to social reality.

Economic theory is - at least in its central core - a theory about commodities and the exchange of commodities. Commodities can be anything in this world, goods or services, as long as they are completely specified, physically, temporally and spatially. Economic analysis usually presupposes a given well-defined commodity space. Every commodity - be it green figs or the services of an electrical engineer - is a given well-defined entity, the amount and price of which can be expressed in real numbers. From the point of view of economic theory each commodity is a black box with a given precise label. What is inside that box - the qualities and internal organization of the commodity - is not of concern to the economist, whose analytical toolbox does not equip him for that task. Instead that task is supposed to be handled by divers technical, or psychological, expertise.

Man as the object of exchange in the educational and labor markets makes up a special class of commodities - commodity man, who is supposed to have all the necessary educational and professional labels to make him a well-defined black box. Once he is so labelled we can supposedly treat him analytically as just another commodity, whose supply and demand and market price can be measured unambiguously.

Given the commodity space, the primary task of economic analysis is to find analytical expressions for the various and intercorrelated activities going on in the economy. For our interest here it is enough to point out three main categories of such activities, education, production and consumption. Here again the economist's ambition is limited. What really goes on within these activities, how the qualities of commodities there are created and appreciated, is something left to pedagogical, technological and behavorial specialists to analyze and express. The economist just takes it for granted that enough of this job has been done already so that he can start with a certain given description of education, production and consumption.

More specifically the description of technologies available for these activities should be given in terms of inputs and outputs of the well-defined commodities. This means the economist needs answers to questions of the following kind. If we put a certain number of men, with secondary school certificates and a given distribution of capability in some well-defined sense, through the existing process of higher education, what mix of doctors, engineers, economists and drop-outs can we get, how long will it take and what other commodities will be needed? How many engineers of different kinds do we need to keep a certain kind of paper process operation running at a given scale? How much paper of various kinds is needed for certain consumption activities, say small-boat navigation, and what is the output

of "satisfaction" as measured in terms of some individual utility index? Given all these "technological" data in terms of commodities or functions of commodities the economist can get started on his special task which is the analysis of how all these millions of divers activities are intercorrelated and controlled, in the most usual case by way of market pricing.

This division of labor, the specialization of economic analysis, has almost certainly been a necessary condition for developing that unified body of analytical tools - general equilibrium theory - in which economists take a justified pride. It has indeed proved most effective, as long as economists stick to their primary task, the analysis of intercorrelated markets. The treatment of man as commodity-man, a well-labelled but otherwise unanalyzed entity, is then a well-motivated analytical conveniance.

Problems will arise, however, whenever the economist oversteps these self-chosen limits and tries to use his tools to analyze the technology and the technological change in education, production or consumption. To do so successfully he would somehow have to break into the black boxes with commodity labels to find out how they are organized , what qualities they possess and why they possess them. This is what technology is all about and technological change means among other things a reorganization of commodity components and a new mixture of physical characteristics. In the case of commodity man used as production input he would need to know e.g. what the elementary skills and capacities are that determine how good a certain professional is at his job and to what extent he can be substituted by some other kind of commodity man. If they wanted to analyze technological change they would also need to know e.g. in what way this vector of skill requirements depended on the machines used and on the general work organization in production, etc. To follow this up with a similar analysis of education they must find out how the training of these skills depends on various multi-facetted characteristics in the trainee and on the educational environment.

There are indeed economists that compete with other social scientists in studying these kinds of questions. But they cannot expect much help or guidance in this from the standard tools of economic analysis. Nor can they hope to arrive easily at results that are simple and general enough to be incorporated into standard economic theory.

What theoretical economists have normally done is to try and find a shortcut into technological analysis by way of simplifying assumptions. Since the paramount difficulty has to do with analyzing the heterogeneity of input and output commodities, the obvious way to try is to assume away most of this heterogeneity. We can e.g. try to describe production technology <u>as if</u> there exists only one kind of machines, one kind of labor, and one kind of output, although machines could be bigger or smaller and men more or less efficient. Even a truely staggering simplification

like this seemingly gains some sort of credibility by a superficial association to the financial concepts of total labor costs and total capital costs. Should we then manage to estimate a production function in these simplified terms - and such estimates have indeed been made by the thousands although it is somewhat difficult to say exactly what has been estimated - we have also found a way to deal simply with technological change. We merely define this change as measured by the change in efficiency in either the machine or the labor unit or both. Technological change is said to be capital-augmenting, labor-augmenting or neutral. An outside critical observer of this whole procedure would probably be apt to think that the attempt rather shows the economist in the role of artful dodger. Technology and its change has been analyzed under the assumption that there is no technology in any real sense that can be changed. An assumption of homogeneity can of course serve equally well if we move from production to education technology. Since the output of education is the labor input to production, assumed to be homogeneous, there must be only one kind of educational results, although individual results, measurable in labor efficiency units or units of "human capital", can be larger or smaller. To arrive at a simple unified formula for education technology, without having to peep inside the black box of commodity-man, we also need a homogeneous input. The student then may be more or less smart, but his degree of smartness should be measurable on some linear scale, in terms of some given efficiency or capability unit.

The homogeneity assumption in education would appear to be at least as hard to support or interpret in terms of real life, as the analogous assumption in production, on which it depends. Not only does it abstract from all questions concerning the structure of educational technology. In as far as education is a way of sorting out people with divers talents and of making use of their comparative advantage for a labor market requiring a successively increasing specialization of skills any homogeneity assumption would appear extremely misplaced.

The one-dimensional man of economic theory thus becomes a very displaced person when he is designated as the central figure of a theory of education. An economic theory of education that attempts to analyze simultaneously the technology of education and production, to explain the role of education and of educated labor within production technology, without breaking into the black box of commodity man, would seem to be doomed to end up in meaningless abstractions or trivalities. To analyze the conditions and fluctuations in the markets for educated labor is one thing - and well within the scope of traditional economic analysis. To try to explain what happens to a man who gets educated, and how this affects his physical contribution in production is something else - and far beyond the limits of applicability for the standard tools of economic analysis. This is our contention here. Let us first take a closer look at the most widely used economic theories of education to see how they appear from this point of view. To what extent do they rest on an assumption of homogeneous labor?

2 The homogeneity of human capital [x)]

The dominant school of thought in the economics of education builds its explanations around the notion of human capital, as reinterpreted and revitalized in the pioneering works of Becker and Mincer; see Becker (1962, 1964) and Mincer (1962).

Research work based on human capital theories has, during the last decade, been extensive, branching off into many divers directions. This makes it by now somewhat difficult to examine the conceptual basis of "the" human capital theory, or, more specifically, to establish the exact meaning and preassumptions of the human capital concept. The author has elsewhere (Ysander (1977) , appended to this book of essays) reported on a modest attempt to explicate the notion of human capital in spite of these difficulties.

Both in economic literature and in common parlance "human capital" is used with many different connotations and in widely different contexts. One trivial but important distinction here is between the notion of physical and financial human capital respectively. Any individual, viewed as a potential source of some kind of labor services, can be said - in the economic jargon - to constitute a physical capital, since 'physical capital', definitionally, refers to something that yields services. That most economists still choose not to treat individuals as capital goods in this sense in their models is mainly a question of practical convenience. As long as you are focusing your interest on market operations and are not especially interested in the rather special category of educational investments, calling people capital goods in the model would simply mean renaming the individuals without getting any analytical gain.

People are not sold on markets or owned by firms like machines. Neither are e.g. the benefits of on-the-job-training offered on the market with a price tag. This means that if you want to treat individuals as capital goods and really study how they change by participating in educational and production activities your model must incorporate distinctions and transactions that have no explicit counterparts in real life markets. If you want to do this in a general way - meaning in a general equilibrium context as

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x) In dealing with the problems in this section I have profited much from comments by Åsa Sohlman, who will present a more extensive analysis of the human capital concept in a forthcoming report within the same research project.

done in Ysander (1977) - it means i.a. assuming that households lease their human capital, i.e. their special labor capacity, to the firms under contracts which stipulate separate charges for the way these capacities are affected by the contracted work. In other words you must be able, always and everywhere, to account separately for all kinds of human investments and disinvestments. What you can gain by such a modelling effort is not really any new knowledge, but simply a consistent way of expressing yourself in discussing how an individual's working capacity develops over his life time. This general use of a concept of physical human capital certainly does not constitute any "human capital theory". It is more of a semantic convention.

The general financial concept of human capital is simpler and more straightforward. Any individual who can be expected to earn money in the future by selling his work services thereby constitutes a financial asset, whose value is the discounted sum of those expected future earnings. This financial concept of human capital can be used as a summary or shorthand notion in analyzing individual expectations and the way the individuals' choice of education and work may be determined by their earning expectations. This is again more a semantic convenience than a specific theory. "Human capital theory" could possibly be used as a kind of general name for all those theories about individual behavior in educational and labor markets that assume earning expectations to be an important determining factor. It would then be a very general name indeed. It can be shown that this financial concept can be worked into the general framework with physical human capital in such a way that you can define things like rate of return on human investments in a way consistent with the analogous definitions for non-human capital. This is not surprising and does not get us any closer toward a "human capital theory" in any more specific sense.

Any theory that is to have some substantial power of explanation must obviously be more than a way of framing concepts. Most of the research efforts of human capital theorists have been directed toward explaining various aspects of the income distribution in terms of human capital. What they are really trying to do is to reverse the reasoning that led to the financial concept of human capital. Instead of defining human capital as the discounted sum of future earnings, the task now is somehow to "explain" future earnings by means of a human capital concept that then cannot be financial but must be physical.

You are then really trying to explain the differential "productivity" of man. In terms of our previous discussion any such analysis and evaluation of the individual contribution to the joint effort in production would require opening the black box of commodity-man to determine the physical and mental characteristics that govern how well he or she operates in the technological organization. If you do not feel equipped for such a

pioneering effort you can always resort to a homogeneity assumption, spiriting away the problems by way of definition.

There can be no doubt that this is essentially what is being done in modern versions of human capital theories, although the exact scope and content of the homogeneity assumptions may vary among the more sofisticated versions of the theory. x)

What assumptions have to be made in a simple and pure human capital theory, aimed at "explaining" relative earnings in terms of accumulated human capital - in terms of what first God and then men have invested in an individual - in such a way that the empirical information necessary for testing could in principle be distilled from existing market data? In what ways must a general equilibrium model with physical human capital be restricted to yield the desired type of relation? One possible way of answering these questions has been presented in Ysander (1977) and can be summarized in following manner.

First of all you should make sure that your explanation of relative earnings is really concerned with the physical productivity of the individual and is not just a way of rehashing the given data on market pricing. Relative earnings should depend only on the given amount of any existing forms of human capital, i.e. the given number of individuals with various earning capacities, but be independent of the rest of economy. This assumption can be shown to be equivalent to a necessary condition for aggregating human capital, for being able to substitute one number representing aggregated labor for the vector of differently skilled individuals in the description of the production technology. There is a certain irony in the fact that human capital theories, thus building on aggregating conditions, was first developed and circulated at the very same time, when - as an outcome of the

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x) At the start of chapter 7 in Becker's book (1964) the author characterizes his own work in the following way: "Virtually all the implications of the theory of investment in human capital developed in Part One depend directly or indirectly on the effect of human capital on the earnings and productivity of persons and firms. Consequently most of my empirical work has been concentrated on measuring and assessing these effects."

That human capital must be interpreted as being physical becomes especially apparant when human capital theorists - - following the example set by Ben-Porath (1967) - introduce a "production function" for human capital (see e.g. the revised version of Becker's book).

The homogeneity assumption is also explicitly stated by Becker in his book (1964): "Another assumption made throughout most of the paper is that human capital is homogeneous in the sense that all units are perfect substitutes in production for each other and thus add the same amount of earnings."

so-called capital controversy - economists finally seemed to agree on the impossibility of capital aggregation in general.

Secondly, you must also assume that the human capital of different individuals is really all the same - just more or less of the same type of capacity. You can always use one man for another man's job but, depending on his relative amount of "human capital", you may then get a bit more or less done than before.

If "human capital" is to become something more than an empirically meaningless variable you also have to relate it to the various investments, training and job experiences, that have been made in order to form this capital. To avoid letting in heterogeneity by the back door you must assume some simple and common process for forming this homogeneous capital. If you want to keep it really simple you must assume that investments also are homogeneous - going to night school or gaining experience as a travelling sales man is really only more or less of the same thing.

Even after these assumptions you are still stuck with the fact that people are different and react differently to human investment efforts. If you want to reach an explanation of relative earnings that is quite generally applicable you somehow have to make people homogeneous. This can be done - and is usually done - by assuming that there is some unambiguously defined property called ability, with which individuals can be more or less generously endowed.

With these successive forms of homogeneity assumptions you can finally arrive at a general hypothesis concerning the relation between ability, investments and relative earnings. Whether you can test your human capital theory will thus mainly depend on the availability of valid and reliable data on this property called ability and on the various forms and measures for human investments.

Since there are many kinds of human capital theories there are certainly many relevant forms of homogeneity assumptions. What can be said generally is that in as far as human capital theories try to say something about the physical productivity of man they do so on the basis of far-reaching assumptions of homogeneity and can - in our view justifiably - be criticized on this account. They are trying to make summary conclusions about the role of man in production technology without really studying either man or technology; the homogeneity assumptions merely express the absurdity of any such attempt.

There is an alternative possible interpretation of the human capital theories. Perhaps "human capital" is not really meant to have any physical counterpart in reality but functions merely as an "intervening" or "theoretical" variable - a practical conveniance in giving a more general form to the empirical hypo-

theses concerning wages as partly determined by training investments? Becker and Mincer were after all colleagues of Milton Friedman at the University of Chicago. In a celebrated essay on economic methodology Friedman (1953) argued that the use of false or empirically meaningless postulates should be accepted as long as they lead to valid and interesting conclusions. (For an interpretation of this argument in terms of theoretical variables cf Ysander (1961)).

The Friedman argument has not found much support among economists and even less among the philosophy of science specialists. Even if it were accepted the burden of proof would anyhow lie with the proponents of human capital theories. They would have to show what general and testable conclusions are added by the introduction of a human capital concept. If the aim of the exercise is to show relative earnings as a well-behaved function of human investments or, more especially, of education, the use of a human capital concept does not seem to help to "explain" this relation in any real sense - but rather clouds the issue.

There are of course many alternative ways of explaining this relation. One such way might start with the idea that although people are different and function differently in production, employers seldom have any reliable means of controlling and measuring these factual differences; cf. e.g. Alchian-Demsetz (1972). By social convention they therefore take educational level etc. as one main starting-point in wage negotiations, since this at least is easily known and documented. They could then be said to practice a homogeneity assumption without having to believe in it. This hypothesis is just mentioned here as one of the many possible explanations that are open to you once you start interpreting human capital theories as theories about people behaving as if there existed a homogeneous human capital. They all have one common feature - that Occam's razor or the law of scientific parsimony would in most cases require you to avoid the use of homogeneous human capital as being both superfluous and cumbrous.

These objections to the use of a physical concept of homogeneous human capital should, however, not be construed as belittling the value of the empirical findings of research work carried out within human capital models. During the last decade this has helped us gain much useful knowledge about the correlations between distributions of human investments and distributions of associated earnings. What has been questioned here are not these data on the yield of various human investments but rather the attempt to interpret and "explain" these data in terms of homogeneous human capital.

3 Filtering homogeneous students: The Arrow model

The best known - or at least most talked about - alternatives to human capital theories in explaining educational impact on earnings are the so called filter theories of education, first presented in pioneering articles by Arrow (1973) and Stiglitz (1972, 1975). The central and rather provocative idea in these models is that instead of developing existing ability by investing the student with new skills, education merely functions as a way of certifying for the employers' benefit the given ability of the student. The rather depressing conclusions to be drawn from these premisses are that in as far as this certification merely affects distribution of income between employees without improving the allocation among jobs, education is simply a social waste.

Filter theories have usually been viewed as representing the extreme opposite to human capital theories. As we intend to show in the following, the two kinds of theories can equally well be seen as rather close - and from an empirical point of view often indistinguishable - substitutes, that both make the same basic assumptions. We use the Arrow model as the point of reference, as it is the simplest and most straightforward of the filter models presented so far. We present his premisses successively, interspersed with comparisons of their implications with those of human capital theory.

Arrow's filter model and human capital theory can be said to share two basic assumptions. First, people and educational processes are assumed to be homogeneous, although some students may be smarter than others. Secondly there is no generation of new knowledge through education, neither about the world around them nor about the students themselves. There is only a redistribution of already existing knowledge.

The homogeneity assumptions mean that as in the human capital theory, the filter theory totally abstracts from the technology of education and from the role of educated labor in production. While it attempts to explain why we have education at all, it cannot touch on the equally interesting questions of what determines the choice of a particular kind of education or a particular kind of job.

There is no search for new knowledge in the filter theory. Education is not a procedure for establishing the scholastic potentialities of the student, which are supposed to be closely, although stochastically, related to general ability or productivity. These individual probabilities of scholastic success are usually[x] supposed to be known already to the student and, after admission scrutiny, also to the school authorities. All that education ever does is to certify for the employers something which is known all along by both students and schools. This means incidentally that the Arrow model cannot really explain why education is so time-consuming, why schools do not just pass on - for a price - the full extent of the information about the student they have gained on admission.

Compared to the human capital theories the filter model could be characterized by saying that its education system redistributes knowledge about the students to employers and the production sector, while in human capital theories the flow of redistributed knowledge goes the other way - knowledge about skills used in production are transferred from production to the students. The big difference is that, while in human capital theories knowledge of skills is assumed to make you more productive, the social value of information about students given to the employers in the filter theories are at best limited.

Does this in itself necessarily make the filter theories empirically very different from the human capital theories? Unfortunately this is not the case. Their conclusions about individual market behaviour could in fact be empirically impossible to identify separately.

What the alternative theories are both stating is that earnings - in terms of which a human capital can always be defined - are a function of ability and educational costs invested by the individual, (we abstract here from the fact that human capital functions have rarely been formulated stochastically as in the Arrow model). You could then in principle choose forms of investment functions and sets of investment possibilities for the individual such that the resulting pattern of investments and earnings in equilibrium would be the same in both kinds of theories. Then, from just studying an equilibrium solution in a real life economy, you could never tell the theories apart. For that you would need to dislodge the equilibrium, e.g. by rationing educational opportunities, and study the consequences on total production.

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x) Arrow sometimes makes the alternative assumption that the students themselves do not know these probabilities (cf. e.g. p. 199 in the 1973 article). This, however, raises the problem - not discussed by Arrow - of how demand or self-selection for education is then determined and what can be known about demand as a sample of the total population.

One such way of bringing the theories closer together would be a kind of perfect filtering process, such that the longer you stayed in education, the higher the ability you could certify - assuming you had it. If wages were paid in proportion to certificates, and education costs were low, educational investments would then be monotonically increasing with ability, which is a common feature of many human capital theories etc.

Looked at from this point of view the provocation of filter models really arises from exploiting a general dilemma of economic equilibrium analysis. As long as we are limited to studying an equilibrium position of the economy in terms of market transactions, we usually cannot hope to distinguish between alternative dynamic explanations of how we have arrived at the equilibrium. Instead of framing the provocation in terms of humans you could equally well let it deal with, say, paper machines. You could make the hypothesis that paper machines are never really used for making paper, as naively supposed. They are instead simply a status symbol used to "certify" your capacity both to the world at large and to the marketing division of the company. You could undoubtedly go on to frame the hypothesis in such a way that it could never be refuted by just looking at an equilibrium solution. Only be getting far enough outside the equilibrium - or by getting permission to peep inside a paper plant - could you hope to settle this controversial question. In the case of the filter theories, you are certainly not supposed to be able to take a close look inside production to watch the performance of naked ability.

We have so far only dealt with those basic premisses in the filter model, that are so to speak generic to the filtering idea and thereby distinguish these theories generally from the human capital models.

The Arrow model has at least two other special traits. These are extremely important for his conclusions but do not necessarily separate his model from human capital theories, into which they could possibly be incorporated.

The first trait has to do with lack of discrimination on the part both of employers and educators.

Although educational authorities are supposed to know at the outset the individual scholastic indicators of relevance to productivity they are assumed to behave in a mean way. After having extracted a price from the students they only give the employers a small and rather distorted part of this information. What the employers get to know is only if the student has passed or not. For the successful students this means that the employers can make an estimate of the average scholastic potentialities, which is then supposed to govern their wage-setting for graduates.

One important consequence of this lack of discrimination, this averaging of certificates and wages, is that it can make edu-

cation profitable also for some less able students who, as graduates, will be paid above what their ability would justify in a more discriminating world. It thus introduces a new source of possible inoptimal allocation into the model.

This assumption about a lack of discrimination in the labor market could in principle also have been superimposed on a human capital model, although it would undoubtedly detract from the formal elegance and simplicity of the theory. It is an assumption about the state of information on the market, which could be combined with many alternative explanations of productivity.

To illustrate that filters may also have a socially beneficient function, Arrow also uses a second set of assumptions about the labor market. Filtering students will obviously improve allocation - if we abstract from educational costs - when the results can be used to assign students between different jobs in such a way that their ability is better utilized. In a model with homogeneous students and homogeneous education it is rather difficult to introduce heterogeneous jobs in any real sense. Arrow avoids this difficulty by assuming a very special segmentation of the labor market. Half of the total utilized productivity of labor must be used for jobs in which only a minimum of potential productivity, common to all labor, can be utilized by each employee. We can visualize these jobs e.g. as manual tasks of operating simple machines, such that any individual can manage one machine but none can cope with more than one for physical reasons. Filtering by education can then help in assigning less able people to these simple but tedious tasks. What is assumed is thus a special combination of indivisibility and complementarity in the labor market.

What interests us here is not whether the assumptions can be said to model any relevant features of real life - which may be doubtful. The point to be made is instead that these assumptions are not in any way necessarily related to the filter hypothesis, although they determine the possible social benefit of an educational filter. Similar assumptions - formulated as limited possible yield of human capital in certain employments - could evidently also be introduced into human capital models.

Arrow's conclusions and evaluations about the equilibrium amount and distribution of educational investments all depend on his special "labor market assumptions". Other assumptions would of course lead to other conclusions. We could e.g. assume that the labor market were partitioned into as many segments as ability, with each segment only allowing the use of a certain limited ability, and that education could function as what we above called a perfect filter, successively filtering out higher degrees of ability. If the marginal productivity gain and wage increase from more education were every-

where larger than the marginal educational costs there would be no risks of inoptimality in equilibrium.

The results of our discussion could perhaps be summarized in the following way. The filter and human capital approaches are usually seen as dramatic contrasts. They could equally well be described as rather close substitutes, which share many decisive basic assumptions, including that of homogeneity. The provocative difference in conclusions - if we abstract from other superimposed assumptions about the labor market etc. - arises from different interpretations of the productivity of educated labor, in a given equilibrium situation. What makes this difference especially provocative is the fact that it may be empirically impossible, within equilibrium analysis, to decide which interpretation is right.

A much more radical departure from current orthodoxy would be a model of search by learning, which incorporated the heterogeneity of students, educations and jobs and the generation of new knowledge in education, by analyzing the educational process as a search for the genuinly unknown qualities of the students. If the only way to find out what you are good at is by learning to do different things, with various degree of success, then the conflict between the alternative interpretations of productivity would also tend to disappear. If ability, as measured on the scales of intelligence tests, merely gives the length of your capacity vector, without telling the direction - which could be even more decisive for your productivity in a special job - then there may not be any competition between the claims of ability and the claims of training. If education is partly a way of "getting to know yourself" as the ancient Greeks believed, then the form and structure of the educational search is all-important and the educational choices for the individual much more complex than what is modelled in current theories.

We mention this possibility here only to emphasize our conjecture, that homogeneity versus heterogeneity is a much more strategic choice for the direction of any future economic research in education than the human capital versus filter interpretation.

4 Homogeneity in educational policy

The homogeneity assumptions in the economic theories of education may not only distort the theoretical conclusions but also lead to misunderstandings in educational discussions and to mistakes in educational policy.

There exists an unfortunate tradition of mutual misunderstanding and disrespect between economists and sociologists. Real communication and cooperation between them nowhere seems so hard to achieve as in the field of education. (There are many outstanding exceptions to this rule - one being our co-author in this volume - Mary Jean Bowman). In view of our earlier discussion of the homogeneity assumption this is hardly surprising. Sociologists, who aim at establishing the differences in people - in background, experience and mental characteristics - that determine their choices of different educations and jobs, must surely find it hard to pursue a meaningful discussion with economists who start by assuming away all, or almost all, relevant differences. In the same manner there seems to be an obvious lack of common ground for economists and pedagogical research workers as long as economists insist on treating as both homogeneous and irrelevant the black box of the human mind, that pedagogical research aims at analyzing and manipulating.

Reasoning about education on the basis of homogeneity assumptions, however, is not a special prerogative of economists. Many policy decisions in the educational field - we refer especially to Swedish policy for higher education in recent years - seem to be based on reasonings of a similar kind.

Discussions about the organization of higher education are often focused on two rather different models, central rationing and decentralized marketing of educational opportunities. Homogeneity assumptions appear to be pivotal in weighing the decision in favor of central rationing.

If you are willing to act as if the homogeneity assumptions were true, i.e. as if students were all the same - only some smarter than the others - and indifferent between various kinds of education this means that students, teachers and local school authorities have no information relevant for distributing various educational opportunities that is not also easily available to central authorities. These authorities, on the other hand, should be able to interpret signals about labor market demands, both in the short and in the long run, better than any one individual in this standard collection of students. Social efficiency reasons

then weigh in favor of central rationing. So as a matter of fact do equity reasons as long as equity can be identified with equal educational and labor market status.

If instead you start from the contrary assumption, that students are fundamentally different in kind and in their aptitude for different sorts of educations and jobs, you will be faced with information problems of quite another dimension. There is so much more you now need to know about each individual in order to channel him or her into the right kind of education and the right kind of job - and much of this information may be available even to the student himself only after a laborious search process. For the same reasons the segments and aspects of labor market information which are relevant will now differ between the individual students. Instead of having almost a corner in relevant information, central authorities now appear to have lost all comparative advantage in distributing opportunities and in steering the individual student through the maze of courses and crafts. With this starting-point you will then tend to favor a decentralized marketing of education services with quality competition for students between the various educational organizations, leaving it to the student himself to interpret and react on market signals both from education and from the labor market.

Even the equity goals may look different from these premisses. If students are really that much different it does not make sense to define equity simply as having an education or a job of equal status with the rest. Strategically important aspects will now be how apt and motivated you were for the kind of education you got, which in turn will determine how well you do and how adjusted you will be in the job your education prepared you for. Equality in education must then be treated separately and independently of equality in the labor market. Equal opportunity to search for and find what you really want to do and feel good at - should constitute the equality aims of education. It will lead to social equality in a more comprehensive sense only if combined with the equalizing of status and pay in the labor market which however requires other kinds of policy instruments. To try to equalize the labor market by way of educational policy is anyhow not only ineffective - at least in the short run - but would also appear to be a rather half-way kind of ambition, since it means that you want to adjust the educational system to the traditional unjustices in the social evaluation of different jobs.

Whether the prevalence of homogeneity assumptions in policy discussions is to some extent due to the impact of economic reasoning or if it just happens that such ideas come naturally and spontaneously to the bureacratic mind, is difficult to know. What our examples above show - if somewhat obiquely - is anyhow that economic theories of education, if taken seriously, could have important - and in our view disastrous - implications for educational policy.

5 From commodity-man to sequential machines

We have so far only discussed the two dominant theoretical themes among the economic theories of education, both of which were found to be based on homogeneity assumptions. This does not mean that there has been no attempt by economists to break into the black box of commodity-man. Such attempts have been made in various directions, although so far without any definitive breakthrough either in concepts or in empirical measurements.

The importance of differentiating, in terms of quality the analysis both of students and education beyond the one-dimensional ability variable has been stressed by many writers who have dealt with education in relation to the labor market; cf. e.g. Blaug (1966) and Rees (1971). A few economists have even tried, theoretically, to define the individual explicitly in terms of a vector or profile of qualifications, which are changed by education and which determine his usefulness in different employments. By so doing you not only gain a way of discussing the students' comparative advantages, when faced with heterogeneous opportunities of education and work. You also overcome a traditional handicap of economic analysis by being able to "explain" and not only register relations of substitution between students and between jobs and the effects of introducing new kinds of education or new kinds of jobs.

Tinbergen (1963) and Mandelbrot (1962) are perhaps still the two best known examples of economists, who have tried to use this kind of model to explain relative earnings. Tinbergen assumes demand for employees in different jobs to be specified in terms of required profiles and then derives a wage function, common to the whole labor market, from the common utility function of the individuals. Mandelbrot goes the opposite way, assumes a separate wage function as well as a totally elastic demand of labor within each job category and then studies the result of simple wage-maximizing by the individuals, who are supposed to be distributed among different profiles in a well-known way. Neither deals explicitly with education. A natural way of analyzing education in these kinds of models would be to describe it as a way of simultaneously changing and gaining knowledge about the originally given profile of an individual.

Further progress in this direction seems so far, however, to have been blocked by the lack of empirical data for interpreting the "profiles" in the models. Early hopes of being able to use e.g. military service records and the results of currently made

so called requirement analyses for different jobs, have all been frustrated. These records turn out, in most cases, not to measure - at least not in a systematic fashion - the kinds of functional qualifications and attitudinal properties that would be needed. This unfortunately leaves us with elegant theories, whose concepts remain empty.

Instead of hoping that knowledge of what are the relevant dimensions will somehow be furnished from someone else - work psychologists perhaps - some economists have recently attempted at least to structure the problem by analyzing the intellectual functions involved in controlling production.

One simple intuitive idea behind these attempts is to draw advantage from the fact that we are living in the computer age. If man can be at least partly replaced in an increasing number of jobs by sophisticated computors, then, surely, we should be able also to do the reverse and analyze some of the main intellectual functions of man in his role as organization man by studying the network of mechanical components that could replace him. Even a rather simple clerical task to be replaced, requires a sequence of elementary computor units with capacity respectively to, say, receive signals, decode and interprete, memorize, apply decision rules, calculate and evaluate consequenses, code and transmit signals, etc. By studying man as sequential machines in different job situations, we might hope to pinpoint some of the main dimensions of intellectual capacity, important for the individual contribution to work in an organization. Machines, however, can be self-organizing only to a certain limited extent and therefore we cannot ever hope to catch all the more creative facets of the work effort. It may anyhow provide a starting-point for what really interests us here, the analysis of how these capacities can be acquired by variously gifted people through education.

Starting from this idea, it seems natural to apply the same method also to the analysis of a whole organization. A pioneering attempt in this direction has been made by Radner and Marshall in their well-known work: Economic Theory of Teams" (1972).

The theory of teams studies organizations as networks of component units for receiving and interpreting information, for computation, for the application of decision rules and for the execution or the transmitting of orders. It can be used to calculate e.g. optimal decision rules and/or optimal information structures for a given organizational network, whose aim or pay-off-function is known. From these calculations you can go on to compare the efficiency of alternative networks, when optimally utilized.

These rather abstract notions can be given some intuitive content by way of a simple and extremely stylized example.

Let us think of a shipping company that sometimes finds it profitable to operate in two special freight markets - here called markets 1 and 2 - where freight rates tend to diverge markedly, both in positive and negative directions, from rate levels in the company's accustomed market, where they are supposed to be able to forecast developments accurately. If they engage in market 1 - with a fleet of a certain given size - and relative rate developments are favorable - let us represent this as $x_1 = 1$ - they stand to make an added profit of α millions of dollars, while unfavorable developments, $x_1 = -1$, will result in a symmetrical relative loss of the same amount. They have only two alternatives in this respect; either they decide to engage - represented as $a_1 = 1$ - or they do not, $a_1 = 0$. Their situation when it comes to market 2 is completely analogous, although here the potential profit or loss amounts to β. There is one complication, however. If they try to engage in both markets simultaneously they will run out of ships and will sustain an extra cost of c millions for hiring the required extra tonnage. We assume that $\alpha > c > \beta$ which means that it can never be profitable for the company to hire outside tonnage.

These assumptions can be summarized in the following pay-off-function which simply states the total relative profit, resulting from the company's actions in these markets:

$$\Pi = \alpha x_1 a_1 + \beta x_2 a_2 - c a_1 a_2$$

Several types of management functions are required to handle this problem. An observation function, O, is needed, to "read" or forecast the relative rate development in the respective markets. On the basis of these forecasts, a decision function, D, must make decisions on whether to engage or not. Finally these decisions must be realized by an executive function, E.

Three alternative networks for combining these functions are depicted in Fig. 1.

The first alternative, Fig. 1a, means that both forecasts and decisions are made centrally and without using specialist knowledge on the respective markets. The price for this lack of specialized knowledge is represented here by an error in forecasting, ε, which with probability q, takes on the value, -1, i.e. makes both market forecasts misleading, but is otherwise equal to 1.

In the second alternative, Fig. 1b, two specialist observers are used, supposedly making the risk of error negligible. Their reports, however, are still fed into a central decision unit etc.

The third alternative differs from the second in that decisions are also made on a decentralized basis by the specialist

observers, which introduces the risk of incurring extra costs by having to hire tonnage.

With specified assumptions on the probability distributions involved - for x_1, x_2 apart from ε - definite conclusions can be derived about the comparative advantages of these alternative networks, when utilized in an optimal fashion.[x)]

What is of special interest to us here is the possibility of deriving organizational demand for various types of intellectual capacities as a function of optimal organizational structure, which in turn will be determined by organizational aims and costs and by environmental conditions.

In our simple example we can study, for instance, the organizational demand for specialist freight market observers mainly as a function of the stochastic properties of the special freight markets involved and of the organizational costs of centralized decision-making. We can thus estimate the value of the contribution or "marginal productivity" of these specialized capacities under varying environmental and organizational conditions. We have then taken a first step towards "explaining" how certain acquired intellectual capacities contribute to the joint output or organizational pay-off- why learning may motivate earning.

---

x) If we assume that the two alternative values of x_1 and x_2, 1 and -1, are equiprobable with correlation coefficient r, elementary calculations show that the expected gross value of alternative c is:

$$E\Pi_c = \frac{1}{2}(\alpha+\beta) - \frac{1+r}{4}c$$

A change over to alternative b - centralizing decisions - increases relative gross profits by the following positive amount:

$$E\Pi_b - E\Pi_c = \frac{1+r}{4}(c-\beta)$$

The effects of a further change into alternative a would decrease the expected relative gross profit:

$$E\Pi_a - E\Pi_b = -(1-q)\left(\alpha + \frac{1-r}{2}\beta\right)$$

These gross profit figures must then be combined with the organizational costs for the various alternatives to arrive at conclusions about the most profitable network.

Figure 1a. Centralized observation and decision

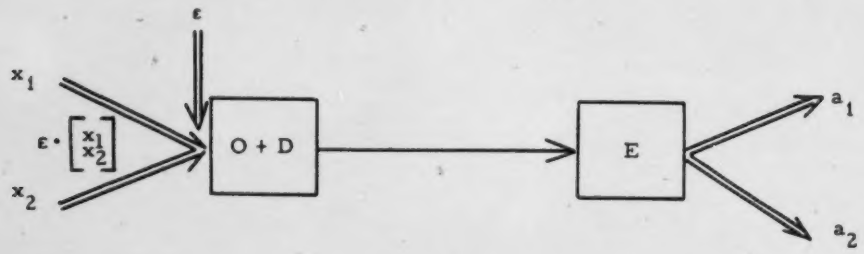


Figure 1b. Decentralized observation and centralized decision

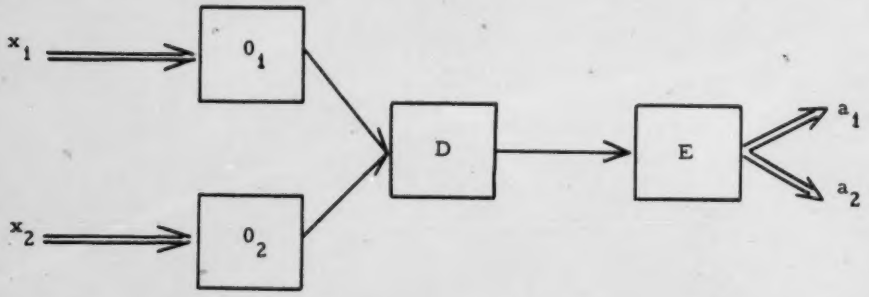
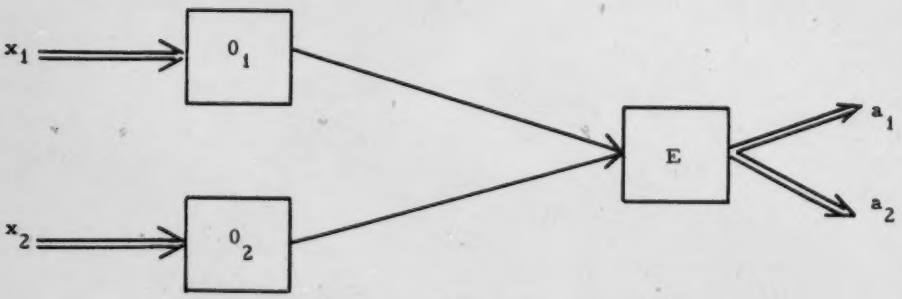


Figure 1c. Decentralized observation and decision



What one would ideally like to envisage is an interpretation of these "computer-capacities" as psychologically measurable categories, so that a start could be made in really analyzing the ways in which education makes people "more productive".

It should be admitted, however, that so far we have little basis for any great hopes in this respect. The theory of teams and

related approaches are still only abstract conceptual schemes, whose empirical usefulness still has to be proved. Moreover the capacity categories used are still probably much too general to make a psychological interpretation possible. But the approach does represent a rather unique attempt to break into the black box of commodity-man in production.

Even if this attempt should prove successful we have only gone part of the way towards an economic theory of the role of education in production. Man is undoubtedly more than a sequence of machines, he is also a living organism, a complex of sometimes conflicting motivations as well as a bundle of creative instincts. The effects of education on productivity must probably be analyzed also in these terms since most changes in the educational system tend to change the psychological and social conditions for study.

6 Education for variety

The conclusions of our discussion of economic theories of education have been mainly negative. It was suggested above that economists have been forced into making homogeneity assumptions when trying to use their analytical tools for problems outside their traditional and legitimate field of market studies - in trying to probe into the "interior" of educational and production processes. By using this "short-cut" their results have also in our view been rendered rather useless but unfortunately tend to support the corresponding policy assumptions which may have far-reaching effects on the shaping of educational organizations. Attempts to develop new analytical methods for the analysis of the "productivity" of educated labor have been made but have not yet been developed far enough to hold definitive promises. Our own conclusion from this would be that economists still have to be very modest in their claims of "explaining" the effects of education in production. They can claim to have real expert knowledge only as long as they stick to those relations in the labor market which can be verified from market data.

We know that the homogeneity assumptions, taken in a literal sense, are false. To substantiate our criticism above we would however need to know <u>how</u> wrong they are in relevant respects; something which unfortunately we cannot know in the present state of research. For the present we have to fall back on subjective beliefs and attitudes. If we start with a one-dimensional view of our fellow-men, it will be consistent to view education as a way of spoonfeeding the test-tube babies in "1984" and educational policy as mainly a question of choosing the spoons. If we base our beliefs on an explicitly pluralistic conception of man-kind, we arrive instead at a conception of education as a way of finding and developing the special talents and motives of each individual within the restrictions given by production technology. The aim will then be an education for variety which also means a variety of educations and a corresponding variety of signals and signposts to make it possible for the individual to make rational choices in each successive step of learning and earning.

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Appendix

Bengt-Christer Ysander

THE MEANING OF HUMAN CAPITAL

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This paper reports on some work carried out within the research project: "Education and the Labour Market", sponsored by the Chancellor's Office at the University of Stockholm. The problem treated here was originally taken up by one of my collaborators on this project, Åsa Sohlman, who intends to present a more extensive analysis of the human capital concept in a forthcoming report. I have profited much from her comments and suggestions.

Introduction

The idea of human capital is as old as the subject of political economy itself and the writings of classical economists are often interspersed with references to the economic analogy between men and machines. In the last two decades, following the seminal writings of Becker, much interest and research effort has been centered on the possibility of building empirical hypotheses around the notion of human capital, aiming e.g. at explaining relative earnings in terms of educational investments.

It is hardly surprising that in this sudden outpouring of writings and studies, many diverse and mutually inconsistent notions of human capital have been exemplified. "Human capital" has usually been treated as a primitive concept, whose exact meaning and relation to other concepts of economic theory is often left unspecified.

Human capital theory has by now matured to the stage where there is a plethora of empirical results to be evaluated, a rising number of competing alternative theoretical approaches and consequently a growing need for a critical appraisal of the central theoretical foundations of the theory.

What is the exact meaning of "human capital" and how should it be fitted into the general equilibrium theory on which human capital theory is supposed to be based?

This paper aims at giving at least a partial answer or one possible answer to these broad questions.

The discussion in the following is divided into two chapters.

The aim in the first chapter is simply to try to fit a very general concept of human capital into the framework of equilibrium analysis, without heeding the more specific needs and notions of so-called human capital theory.

If we really want to treat men as machines, i.e. as heterogeneous capital goods, taking part in production and being changed by production in various ways, how can this be formally represented? In contrast to machines, men are not tradable and investment in men means investment not in production but in change.

It will be shown that to make room for separate accounting of human capital and human investments the usual equilibrium framework must be modified both as to institutional assumptions and the specification of commodity space.

Once this is accomplished human resources can be socially accounted for in analogy with machines or buildings. This means, as it is spelled out in section 1.6, that we can have a human capital theory in the sense of a financial account for human capital and investments following the usual accounting rules for profit rate and rate of return on capital in equilibrium.

This may be enough to explicate the meaning of classical references to human capital in general but it certainly does not provide a basis for human capital theory in the modern sense of Becker. The second chapter is dedicated to an attempt to give a stepwise account of the further restrictions on the general equilibrium model, that are needed to provide a notion of human capital useful for the purpose of explaining relative earnings.

Searching for conceptual clarification is seldom exciting and often rather tedious. It is, however, a necessary starting-point for any critical reappraisal of a theory's viability and validity.

1 Human capital and general equilibrium

1.1 The context: A myopic general equilibrium

The Arrow-Debreu model of general equilibrium as presented in Debreu (1951), Arrow-Debreu (1954) and Debreu (1959), has a well-known intertemporal interpretation involving the assumption of dated commodities and of a complete set of spot and forward markets.

The general equilibrium framework we are going to use here is a respecified, reinterpreted and somewhat extended version of this intertemporal Arrow-Debreu model.

The production possibilities of the firms will be presented disaggregately and specified period by period under the assumption that outputs of a particular date depend only on inputs at the preceding date. This way of representing production by period in terms of a generalized activity analysis was first introduced by Malinvaud (1953 and 1972) and has later been used, discussed and developed in Bliss (1975).

The intertemporal equilibrium will also be reinterpreted as a temporary equilibrium, existing in each consecutive period. In the Arrow-Debreu model the economic agents make transaction decisions once and for all in the first period, after which they are faced with an over-all budget restriction and have access to a full complement of forward markets. In a temporary equilibrium model the agents are assumed to make decisions concerning transactions only in the current period. They only have access to spot markets including a bond market linking current transactions with the future. The relevant budget restriction also holds for current transactions only. From current prices and interest and expectations about future prices and interest the agents decide on an optimal allocation of their budgets. A temporary equilibrium will ensue when these decisions are such that supply equals demand on spot markets and the bond market.[x)]

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x) Early examples of the use of a temporary equilibrium concept are provided by Lindahl's classical paper from 1929 and Hick's discussion of a "Spot economy" in his 1939 book: Value and Capital. A survey of temporary equilibrium models and of the contemporaneous efforts to extend these models to deal with situations involving uncertainty and quantitative restrictions is given in Grandmont (1976).

If we assume that agents have perfect foresight and that their plans are fully consistent so that their price and interest expectations will all come true, we get a very special kind of temporary equilibrium or rather a sequence of such equilibria. This is very close to the original Arrow-Debreu model since in both cases the agents make all decisions with full knowledge of the true development

For our purposes here the use of a model of temporary equilibrium with perfect foresight affords the advantage that definitions and discussions of human capital concepts can be made simpler and more intuitive by being framed in terms of current period decisions. By suitable assumptions on the firm's financial arrangements the firms will also be seen to behave myopically in this model, i.e. they will make their decisions on the basis of current input-output possibilities only and will endeavor to maximize current dividends. That is the reason why we have chosen to call the model myopic general equilibrium - in the following abbreviated as MGE.

But if we wish to pursue the discussion in terms of an arbitrary period we must also remove the asymmetrical treatment in the Arrow-Debreu model of the first and last periods. This will be done - following Svensson (1976) - by allowing for initial debts in the first period and by letting the model extend into an infinity of future periods. There is, however, a price to be paid for this pedagogical convenience. Although equilibria with bankruptcy and with an infinity of commodities have been examined recently there can be no assurance here of either the existence or efficiency of this extended version of the model. A further extension in comparisons with most standard equilibrium models will be made here by allowing for the possibility of negative prices for some special goods. How this can be done and what it implies has already been shown - first by Arrow (1951) and Koopmans (1951).

As an obvious safeguard against perverse cases made possible by the infinite horizon we also have to assume convergence for the various discounted values involved. This will in particular exclude the case where expenditure is financed by indefinitely postponing the payment of an ever-increasing debt. x)

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cont.

of prices and interest over time. It differs solely in the respect that the over-all budget restriction in the Arrow-Debreu model is now broken down into a series of temporary restrictions linked by the bond market, forcing the agents to postpone their transaction decisions in a corresponding manner. It can also easily be shown that the perfect foresight temporary equilibrium is equivalent to the Arrow-Debreu model in the sense that any consumption and production allocation in one model can also be realized in the other. This has been shown by Guesnerie - Jaffrey (1974) for the exchange economy and by Svensson (1976) for the economy with production.

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x) The MGE-model here used is very closely related to Malinvaud's model (1953) and its specification has borrowed many traits from Svensson's paper (1976). It differs from Svensson's model mainly in the special institutional arrangements and the more general treatment of non-produced factors of production used here as a means of explicitly introducing human capital.

1.2 Production and consumption

In presenting the model we begin with its more general features; the special characteristics needed to deal with human capital will be introduced in the next section.

The economy has I consuming households and J production firms. In addition to this each household is assumed to own and operate one of I holding companies. The raison d'être for these holding companies will be given in the next section.

There are at each date at most U goods, including both commodities and services, both produced goods and non-producible factors. Time extends over $t = 0, 1, 2 \ldots$ up to infinity. We want to study the economy at an arbitrary date t. For the later specification of the full intertemporal equilibrium, however, it is most convenient if we choose to study the economy at $t = 1$.

At any chosen time ($t \geq 1$) there are spot markets for all of the U goods and also a bond market, with prices, $p_t \in R^U$, and interest r_t.

A household i at time 1 can be characterized by a quadruple $(C_i, \preceq_i, \nu_{io}, c_{ibo})$ where $C_i \subset R_+^\infty$ (R^∞ is used here as an abbreviated notation for the countably infinite sequence $R^U \times R^U \ldots$) is the consumption possibility set of which the elements $c_i = (c_{i1}, c_{i2} \ldots) \in C_i$ are consumption sequences, with $c_{it} \in R_+^U$ ($t \geq 1$) being consumption at date t.

$\nu_{io} \in R_+^{I+J}$ ($\nu_{ioi} = 1$, $\nu_{ioj} = 0$, $j = 1 \ldots (i-1)\ (i+1) \ldots I$, $0 \leq \nu_{ioj} \leq 1$, $j = (I+1) \ldots (I+J)$) denotes initial shares for household i in holding companies and in production firms, respectively. c_{ibo} denotes initial bond holdings. $\nu_i = (\nu_{it})$, $\nu_{it} = (\nu_{itj})$ and $c_{ib} = (c_{ibt})$ are defined correspondingly.

The household in this model thus has no initial endowments. Its initial wealth is entirely of a financial nature, consisting of shares and bonds, while all physical capital is held and managed by the holding companies. Its disposible income in consecutive periods will therefore be made up of dividends from shares held and interest on bond holdings. For simplicity's sake we further assume for the moment that there are no durable consumption goods, so that the household's current purchases are fully consumed in each period.

Let us denote dividends in the various firms and companies at time t, $d_t = (d_{jt})$ $(j = 1 \ldots (I+J))$

and represent the value of all shares in the respective firms at the same time $v_t = (v_{jt})$ $(j = 1 \ldots (I+J))$.

The budget restriction of household i can then be written as:

$$(2.1) \quad p_t c_{it}^{x)} + c_{ibt} + v_t(\nu_{it} - \nu_{i,t-1}) \leqslant (1 + r_{t-1})\, c_{ib,t-1} + \nu_{i,t-1} d_t$$

The left-hand side of (2.1) consists of the different forms of household outlays - consumption purchases, bond purchases and net purchases of shares. The right-hand side contains two forms of household income - interest on bond holdings and dividends.

Each household i is assumed to maximize $\gtrless_i$ on the set of all c_i, c_{ib} and ν_i that fullfill the budget restrictions with given c_{ibo} and ν_{io}.

For the production firm j we assume that its production possibilities in any period t can be represented by a set $(z_{jt}, q_{j,t+1}) \subset R^U \times R^U$ where z_{jt} is input at date t and $q_{j,t+1}$ is output at date $t+1$. We thus assume that output in any period depends on inputs in the preceding period but not on inputs at earlier dates.

Each period the production firm rents its inputs from the holding companies in the form of services or use of material goods and non-producible factors held by these companies. The firm pays, with interest, for the inputs advanced by the holding companies when these inputs have matured after one period into outputs. The firm is thus free from both financial worries and responsibility for the management of physical capital, since these functions are handled separately by the holding companies. These can therefore be looked upon as representing the pure capitalist functions while the production firms account only for current production decisions, i.e. handle the production technology. The outputs of the firms are sold to households for consumption or to holding companies for what we might call gross investment. The dividend at time t will be:

$$(2.2) \quad d_{jt} = p_t q_{jt} - (1+r_{t-1}) p_{t-1} z_{j,t-1} \quad (j = (I+1) \ldots (I+J))$$

The firm is supposed to maximize the discounted value of future dividends, where the discount factors are defined as:

$$(2.3) \quad \beta_1 = 1$$

$$\beta_t = \frac{1}{1 + r_{t-1}} \quad (t \geqslant 2)$$

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x) For a further development of this term, see footnote in the beginning of section 1.5 below.

From our assumptions above, however, it is apparent that, since each dividend depends only on current technology, prices and interest, this is equivalent to letting the firms maximize each consecutive dividend separately, i.e. having them act in a myopic fashion.

For the starting period we must assume that inputs in the previous period, z_{j0}, are given. With this restriction, the behavior rule for the firms can be stated simply. In each period t each firm maximizes its dividend as given by (2.2) above on the set of its production possibilities $(z_{jt-1}, q_{j,t})$.

1.3 The holding companies

In most standard models of this kind only two types of institutions are recognized: households and firms. Between them they then share the responsibility for managing the social capital. The household may e.g. be the owner not only of its own labor capacity but also of land resources, i.e. the households hold the nonproducible resources, while the firms hold the produced capital.

In this model we have chosen to make a further division. Mainly in order to afford human capital a treatment analogous to that of physical capital, we have separated the resource management function into a separate institution called a holding company. Each household is assumed to have its own holding company, which manages various amounts and sorts of the three different kinds of social capital: real estate, human resources and production capital, i.e. reproducible capital including everything from raw materials to durable machinery. What then remains for the household proper is mainly a consumption-saving function although we have found it convenient for later use of the model to let the household also retain the financial investment function, i.e. to be able to buy not only savings bonds but also shares in production firms. The function remaining for the production firms is the economic use of a given production technology.

The holding company owns and manages the human resources - the human capital - of the household. This arrangement may sound strange but means merely that for accounting reasons we have chosen to separate the resource managing functions of the household. This may be expressed by assuming that the current trend towards conducting household business through companies - mostly due in fact to tax reasons - has become the rule.

Each holding company finances its operations for each period separately by selling bonds to households on the bond-market. With this money it purchases the various kinds of non-human capital in the beginning of each period. It then immediately rents out its capital to production firms. In the special case of human capital the holding company also rents part of it - the leisure hours - back to the household at the current market wage. At the end of each period it gets back the capital - or what is left of it - and a rent payment with interest. It then sells out the capital and uses the proceeds together with

rent- and interest income to pay back the bond loans, while the surplus is given back as dividends to the household as sole owner of the company.

Since there is no trade in holding company shares there will be no market price. The same is true of human capital, for which a discounted value can be defined, but no market price.

The explication of the human capital concept in general equilibrium conditions would undoubtedly be much simpler and more straightforward if we dared, for modelling purposes, assume some kind of trade in human resources. Before proceeding, it may be worthwhile to comment on the reasons why this does not seem possible.

The reasons are usually regarded as obvious. You cannot go out on the market and buy human beings - there is no slave market. If this argument is taken to imply that labor contracts are always such that they only cover the short-term disposal of labor for specific tasks, then this may not be wholly convincing.[x)]

Any attempt to introduce human capital trade into a general equilibrium model does, however, run into other difficulties which have to do with the individual and indivisible nature of human capital. To account for the fact that you are only interested in buying and consuming your own leisure time, not the time of some equally worthy individual, and that your incentives to utilize training opportunities depend on your reaping the benefits, each person or each household would have to be identified as a separate kind of human capital. Equally obvious is the fact that while you may part-train a man, you cannot train just part of him - from the point of

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x) Most people are not hired on a purely temporary basis - on "cotton-picking contracts". Employment contracts may assume a long-term view and various employment benefits may be credited to the employer on this assumption. This in fact is what is usually meant when current discussions refer to the trend towards "Japanized labor". A corresponding assumption of long-term utilization can often be traced - and is sometimes explicitly stated - in the conditions for various public employment benefits and training programs. One way of modelling these actual conditions would undoubtedly be to allow for the possibility of selling part of one's own human capital. Contracts can of course always be broken and tacit assumptions can be proved wrong - but usually there is some penalty involved. This then would merely mean - in model terms - that you can always buy back full control of your own labor even if you have partially "hocked" it, as it were, to your employer or some public agency - but this usually involves raising some extra money to make up the part of your capital value you had already mortgaged.

view of developing human capabilities, man is indivisible. If you therefore sell part of him, any change in his capabilities occasioned by his use will introduce externalities between the various agents involved. It thus seems that to assume trade in human capital in an attempt to model real life conditions creates more problem than it solves.

In terms of the kind of generalized activity analysis used here, the treatment of durable capital presents no special problem as long as capital ownership is kept within the production firms themselves. The capital goods before usage are accounted for as inputs and the used and possibly also changed capital goods are registered as outputs in the production technology. There is then no need for explicitly accounting for either use or the accompaning change brought about in the capital goods. When ownership and resource management is placed outside the production firms as in our model here, a new need arises to identify the flow of services between the resource users - the firms - and the resource owners - the holding companies. We have to consider not only the fact that the resources are used but also how they are used, since this affects the shape of the resources when they come back from their use in production. One reason for using holding companies in the model is indeed to make room for this kind of separate service accounting. When it comes to human capital we are not only concerned with what it can do in production, but almost equally interested in identifying what various productive processes can do to develop human capabilities.

The process of accounting for service flows can be modelled in various way. We have chosen to assume that two identifiable "capital services" are involved in any use of a capital resource of a certain kind and quality in production. One is the resource user service, an input in production, which depends only on the resource hired, not on the purpose for which the resource is rented. The user charges can be assumed to be positive throughout. The other is the resource development service, an output in production which, like any other output, depends on the kind of productive activity carried on. The development charges may be either positive - reflecting an improvement in the resource through production usage - or negative - compensating a depreciation in the capital good. The sum of user charges and development charges is the total rental paid for the capital good. For production capital we have made the simplifying assumption that these goods are affected in an identical way by all productive uses, which means that only one rental service and one positive, rental price have to be identified.

The holding companies' transformation possibilities thus in general involve transforming a capital good and a development service into another capital good and a user service. As long as there are a finite number of ways in which a capital good can be changed, the activity analysis can obviously always, in a formal sense, be transformed into this kind of description by a suitable increase in the still finite number of goods in the model. Whether it is also a

practically convenient way of modelling real life will depend on the number or standardization of the development services for human and real estate resources that production gives rise to.

It is natural although by no means necessary to think of the transformation possibilities for a holding company as additive, i.e. as being the sum of the separate possibilities for various kinds of capital goods. This would mean that there are no "external effects" between different kinds of resource management. If the transformation possibilities concerning real estate and production capital differ between households this must be interpreted as due to differences and gaps in the mercantile knowledge necessary for handling special kinds of resources. Some households may e.g. not be equipped to handle certain complex kinds of real estate.

We also assume production technology to be such that the volume and character of development services produced with certain resources can be varied and furthermore that these services can be assigned in various ways to the resource units involved in the production process. Specifically we assume that for each relevant kind of resource there is one productive employment actually used which leaves the resource - real estate or human - unchanged.

The household, however, must buy the development service from the same firm which utilizes the unit to be developed. This kind of "tied sales" usually introduces an element of arbitrariness into market pricing. Under the above-mentioned assumptions, however, this will not be the case. The working of the model will be the same regardless of whether we account for the two kinds of services separately or not. There will always be one unique way of splitting the total rental into a user charge and a development charge.

After these introductary remarks we can continue specifying the model by dealing in turn with the three factors of production handled by the holding companies.

1.4 Factors of production

There are three kinds of factors of production in the model: real estate, human resources and production capital.

Real estate in this context refers to more than just land. It covers everything implied by the French word "immobilier", i.e. it includes all immovable properties or objects on land, e.g. roads, various cultivations and land improvements, houses and fixed machinery. The use of such a broad definition of real estate is needed once we want to remove the ownership of the factors of production from the production firms and establish instead a short-term leasing market. There is e.g. no acceptable way of establishing housing rents without involving land use, etc.

A piece of real estate can be described in terms of two different kinds of characteristics, unchangable and changable, respectively. Unchangable characteristics are the various locational properties, geographical coordinates, geological and climatological conditions, etc., that is, everything that determines its latent use and development possibilities. We assume that all existing real estate can be partitioned into a finite number of groups or types, each homogeneous as to these unchangable characteristics, and that the number of units in each such type is given once and for all. Real estate is thus non-reproducible - and eternal - as far as type is concerned.

Through various kinds of land improvements and construction activities the real estate acquires new changable characteristics, which together define the actual state of a certain piece of real estate. We assume here that there are a finite number of such possible actual states and that current real estate rentals depend only on these states. Real estate is thus in a certain sense reproducible when it comes to the actual state of the land. A piece of land will over time pass through a certain state-cycle. The responsable holding company can, by buying different real estate development services, determine each step in this cycle.

Each unit of real estate belonging to a certain holding company at time t can thus be identified as, $e_{it}^{\alpha\beta}$, where α gives the type while β in a corresponding manner refers to the state. We will let $e_{it} \in R_t^U$ denote a vector with zero for those components that do not correspond to some particular kind of real estate owned by the i'th holding company at time t. By $e'_{it} \in R_t^U$ we denote correspondingly the one period use of real estate in different states. Given the assumptions made, the number of non-zero components in e'_{it} will at most equal the number of different states.

Finally we use $\dot{e}_{jt} \in R_t^U$ to denote the real estate development services rendered at time t by the j'th production firm. The number of possible services of this kind - forms of construction, land improvements, etc. - is assumed finite but may be smaller, or bigger, than the number of different kinds of real estate.

One consequence of our definition above may be worth pointing out. In removing all "immovables" to outside ownership we have also eliminated the most common explanation for differences in production possibilities between firms. The task of these firms is now restricted to combining current available services in the most profitable way. The remaining differences in technological possibilities in a certain period must then wholly be ascribed to differences in technological knowledge between the firms. However, the change is more semantic than factual. Instead of saying that a firm can use certain processes because it already has a certain plant built we now

say that although it does not itself own the plant it is the one who knows how to operate it.

When we pass to the second factor, human resources, we use definitions and concepts, analogous to those utilized above for real estate. There is one aspect of human resources that is especially troublesome in a model with infinite horizon. People, in contrast to land, die sooner or later. To avoid the complexities arising from this, we make the following simplifying assumptions. Each household reproduces itself indefinitely in such a way that its size and structure remains unchanged. The household may therefore calculate as if each individual of a certain type, i.e. with certain unchangable or inate characteristics, was immortal but necessarily passing through a predetermined life-cycle of aging before "passing into its second childhood".

By various kinds of training, i.e. by being exposed to various kinds of human development services in production firms, an individual may acquire different sorts of skills and capabilities, new states, and thereby pass into new phases of a state-cycle.

Analogous to what was said above about real estate, we assume that these possibilities for transformation or cycling depend on the type or inate characteristics.x) While types of individuals are non-reproducible, states are in this sense reproducible. The model thus encompasses all sorts of "life-long education", while all training is defined as "training on the job", even for the case where the job is just training.

Corresponding to our real estate definitions, we let $h_{it} \in R^U_t$ denote the vector measuring the human resources of the i'th holding company at time t, with non-zero components indicating its holdings of the various combinations of type and state of labor.

Likewise we let $h'_{it} \in R^U_t$ denote the use of the different states of human resources, assuming again that the number of non-zero components will at most equal the number of different states. While the individual type determines his development possibilities we thus let his current usefulness in production depend solely on his state, i.e. his actual skill or capabilities.

Finally $\dot{h}_{jt} \in R^U_t$ represents the various human development services or training (or detraining) opportunities produced at time t by the j'th firm. Nothing is assumed about the number of such opportunities except that it is finite.

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x) A similar treatment of training as being produced jointly with commodities and "sold" jointly with employment, has been presented by Rosen (1972). He starts off, however, at the point where this paper ends i.e. with homogeneous human capital. Since his purpose is rather to explore some implications of "training on the job" for the choices of employers and employees, his concepts are furthermore not framed within a general equilibrium context. Our MGE-model would seem to meet - and pass beyond - the suggestions for generalisation of the Rosen-model put forward by Rosen himself in his note 9.

The third kind of factor is production capital, i.e. all reproducible inputs that are not incorporated into real estate or human resources. Although even in this instance one may talk about recycling in the sense used in industrial and environmental economics, there are no longer a limited number of non-reproducible individuals of certain given types. For simplifying reasons we assume here that for each commodity there is just one standardized change brought about by its use in any production process. To each unit of a capital item thus corresponds a unit of one capital service. Analogous to the definitions above, we denote the production capital owned by the i'th holding company at time t by $\bar{q}_{it} \in R_t^U$, and the production capital services produced by the i'th company $q_{xt} \in R_t^U$.

For "current inputs" or "circulating capital" the transformation possibilities for the holding companies will show the capital services only as output, the capital having been consumed in the process. Should one also wish to allow for "consumer's durable", this simply means that production capital services can be bought from the holding companies also by households.

1.5 Completing the specification

As a general representation of the capital goods bought as input by the holding company i at time t, we use k_{it}^-, and for the corresponding output k_{it}^+, defined as follows:

$$(5.1) \qquad k_{it}^- = e_{it}^- + h_{it}^- + \bar{q}_{it}^-$$

$$(5.2) \qquad k_{it}^+ = e_{it}^+ + h_{it}^+ + \bar{q}_{it}^+$$

In the same way we define the capital use services produced by the holding company as k'_{it} :

$$(5.3) \qquad k'_{it} = e'_{it} + h'_{it} + \bar{q}'_{it}$$

The only difference between the capital use services produced and those consumed by the production firms is the consumption of leisure time and of real estate services by the household. We denote these by c_{ist}:[x)]

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x) To take into account the household's purchase of leisure and of real estate services, to be paid afterwards like all capital services, the budget restriction for the household given above in (2.1) must be rewritten as:

$$(2.1b) \qquad p_t c_{igt} + (1+r_{t-1}) p_{t-1} c_{is,t-1} + c_{ibt} + v_t (\nu_{it} - \nu_{i,t-1}) \leq$$

$$\leq (1+r_{t-1}) c_{ib,t-1} + \nu_{i,t-1} d_t$$

where $c_{igt} = c_{it} - c_{ist}$, i.e. all consumption except capital services.

(5.4) $\sum_i (k'_{it} - c_{ist}) = \sum_j z_{jt}$

Capital development services were defined separately only for real estate and human resources, which leads to the following definition for the purchases of the i'th company:

(5.5) $\dot{k}_{it} = \dot{e}_{it} + \dot{h}_{it}$

The utilization or transformation possibilities for holding company i in period t can then be represented by set

$T \subset R^U \times R^U \times R^U \times R^U$ where $(\bar{k}_{it}, k'_{it}, \dot{k}_{i,t+1}, k_{t,t+1}) \in T$.

$\bar{k}_{it}$, and $\dot{k}_{i,t+1}$, are both inputs although one period apart and the outputs, k'_{it}, and $k_{t,t+1}$, are separated in the same way. x)

Apart from transformation possibilities for all periods the holding company i will also be characterized by the initial capital, capital leasing and debt, i.e. k_{io}, k'_{io} and k_{ibo}.

The dividend for the holding company i at time t is defined so as to include the imputed value of leisure time. It can then be written as:

(5.6) $d_{it} = (1 + r_{t-1})p_t k'_{i,t-1} + p_t(\dot{e}^+_{it} + \bar{q}^+_{it}) + k_{ibt} - p_t \dot{k}_{it} -$

$- p_t(\dot{e}^-_{it} + \bar{q}^-_{it}) - (1 + r_{t-1})k_{ib,t-1}$

The first three terms on the right-hand side represent the

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x) The representation of transformation possibilities is simplified here by not explicitly stating the restriction to tied purchases of development and user services.

The net product of the holding company at time t can be written as: $k^+_{it} + k'_{it} - \dot{k}_{it} - \bar{k}_{it}$

If this net product is integrated over the whole economy with the corresponding net product for the production firms, the flows between companies and firms will no longer appear in the final term. Apart from household consumption including leisure time, the total net product will evidently only show the difference

$\sum_i (\dot{k}^+_{it} - \dot{k}^-_{it})$

denoting the demand for investment in new capital goods. In such an integrated model we no longer get a separate representation of the demand for investment in old capital goods, $\sum_i \dot{k}_{it}$.

company's sources of income, i.e. user charges with interest, sales of capital goods and new bonded loans. The last three terms correspondingly denote the various outlays, i.e. development charges, capital goods purchases and repayment with interest of old bond loans.

The holding company will try to find such time sequences of $\bar{e}_{it}$, $\bar{\bar{q}}_{it}$, $\dot{k}_{it}$, k'_{it} and k_{ibt}

that will maximize the discounted value of expected future dividends, $\sum_{t=1}^{\infty} \beta_t \, d_{it}$, with the restrictions given by the period transformation possibilities and the initial values.

If we utilize the assumption mentioned earlier of additive transformation possibilities, dividends could be defined separately and maximized for each of the three sections within the holding company: the real estate department, the labor department and the material department. Since operations in real estate and material are financed separately by bond loans in each period and the transformation possibilities at each time t depend only on the decisions taken at the preceding time, $t - 1$, we immediately see that the myopic quality, which was found to characterize decisions in the production firms, would also be true of operations in real estate and material. Each of these departments could equally well maximize its dividends separately for each period. Since we do not have trade in human capital, this possibility of myopic decision-making does not exist where human resources are concerned. The company must then itself take into account the effects of current decisions concerning employment and training on future labor dividends, instead of having this done by the capital evaluation of a market.

To complete the specification of the equilibrium model, all we need now are the equilibrium conditions. There are three of them. For each $t \geqslant 1$ the following should hold:

$$(5.7) \quad \sum_j q_{jt} + \sum_i (\bar{e}^{+}_{it} + \bar{\bar{q}}^{+}_{it}) + \sum_i k'_{it} = \sum_i c_{it} + \sum_i (\bar{e}^{-}_{it} + \bar{\bar{q}}^{-}_{it}) + \sum_j z_{jt} + \sum_i \dot{k}_{it}$$

$$(5.8) \quad \sum_i c_{ibt} = \sum_i k_{ibt}$$

$$(5.9) \quad \sum_i \nu_{ijt} = 1$$

The first equilibrium condition, (5.7), establishes equilibrium on all non-financial markets. The three kinds of supply on the left-hand side are, respectively: production of firms, capital goods sales and capital leasing by companies. On the right-hand side are the four kinds of corresponding demand: household consumption including leisure time, company purchases of real

estate and material goods, firm purchases of inputs and finally company purchases of development services.

The second condition, (5.8), simply states that supply should equal demand also in the bond-market.

(5.9) states that conditions on the share market are such that for every share of every firm there is always someone willing to hold it at the going price.

This ends the specification of the model. Apart from stating the equilibrium conditions we have characterized and stated behavior rules for the three kinds of agents, consumers, firms and companies.

Perhaps a word should be added on the v_{jt}, the value of the j'th firm's stock of shares at time t, since the determination of these market values may not be apparent from the specification. In equilibrium, any change of stock value over a period can only be due to the expected dividend. This means that if we assume, as we already have done above, that the discounted value of the sum of future dividends converges, then the value it will converge towards is the discounted stock value, i.e.:

$$\beta_t v_{jt} = \sum_{\tau=t}^{\infty} \beta_{\tau+1} d_{j\tau+1}$$

A picture of the structure of the assembled model for period t with aggregated sectors is presented in fig. 1. For the production firms collectively and individually the choice in each period is, as shown, simply that of picking an input-output pair that maximizes the dividend. The households taken together must distribute their dividend income in an optimal fashion between consumption and bond investments. The task for the holding companies, the truely "capitalistic" task, is somewhat more complex. They must find combinations of on one hand capital utilization and on the other hand investments in new capital goods or in existing real estate and human capital, that will maximize the discounted value of future dividends.

1.6 Income, wealth and the rate of return on human investments

Within the model, as specified above, some concepts of social accounting can easily be defined.

Gross national product (GNP) in period t can be directly defined as:

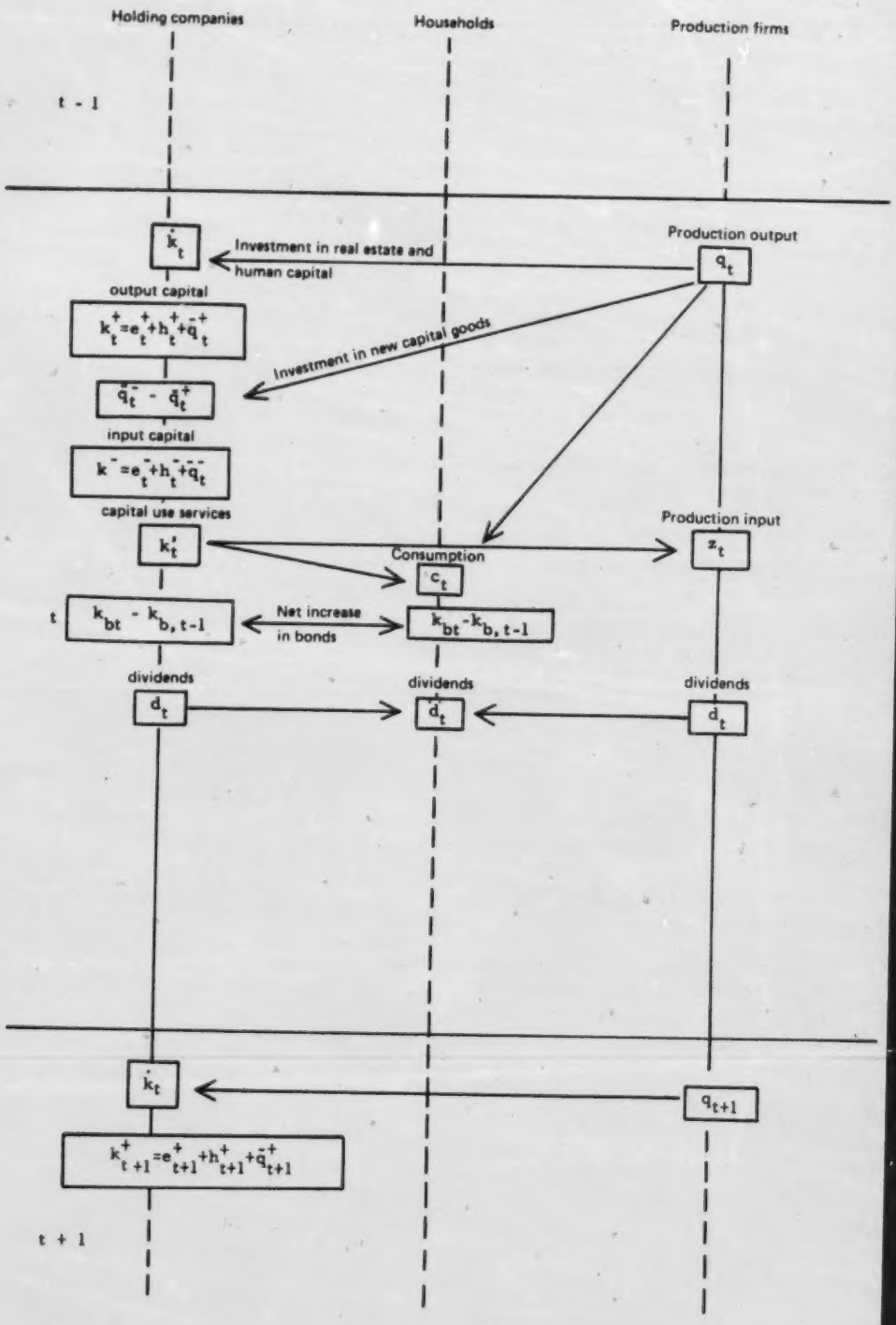
$$(6.1) \qquad GNP_t = \sum_i p_t \{ \dot{k}_{it} + (\bar{q}^{-}_{it} - \bar{q}^{+}_{it}) \} + \sum_i p_t c_{it}$$

This simply means that:

GNP_t = Gross Investment + Consumption

There are two kinds of investments involved. The first term on the right-hand side of (6.1) denotes the investments in non-

Figure 1. The structure of the model in period t with aggregated sectors



reproducible factors, i.e. the total value of development services. The second term represents the gross investments in new material goods and reproducible factors. The third term, denoting consumption, also includes consumption of leisure time. Although this is against social accounting practice, it is motivated here by the importance of leisure value as part of the yield of human capital.

Viewed from the production side the GNP_t could equally well be written as:

$$(6.2) \qquad GNP_t = \sum_j q_{jt} + \sum_i c_{ist}$$

where $c_{ist} = c_{it} - c_{igt}$, as earlier introduced, stands for the household consumption of real estate services and leisure. These services are thus added to the current output of the production firms to give the GNP. In these definitions we abstract from the fact that, in the model, service consumption is paid with interest in the succeeding period, as are service inputs to production. The internal loan transactions between households and their own holding companies are of no concern for the social accounting purposes indicated here.

To go from GNP to national income concepts we have to use capital values to measure changes in wealth. Since there are no market prices for human capital - or formally since p_t is defined with zero components for human capital - we must somehow directly define human capital values. This can be done analogous to the way stock values of firms were defined (see section 5 above), i.e. as discounted values of future expected yields.

Let us make the following simplifying assumptions. We assume that the transformation possibilities of the holding firms are additive also down to each individual unit of human capital, i.e. each labor unit can equally well be managed and accounted for separately. This means that for each individual at each time, we can identify in equilibrium the most profitable sequence of future yields. We further assume that holding companies have equal opportunities when it comes to managing labor. Since holding companies are managed competitively, maximizing the discounted value of the sequence of future yields, i.e. the capital value of the human resources, this means that in equilibrium each unit of human resource of a certain type and in a certain state will have the same capital value. One such unit, let us call it h^* (a vector with only one non-zero component) will undergo a cycle of transformations over time although retaining its individual identity. Its capital value at time t can be defined as:

$$(6.3) \qquad v_{h^*t} = \frac{1}{\beta_t} \sum_{\tau=t}^{\infty} \beta_{\tau+1} \{ (1 + r_\tau) p_\tau h^*_\tau - p_{\tau+1} h^*_{\tau+1} \}$$

The expression on the right-hand side of (7.3) is simply the discounted value of the future rentals or yields of the human

capital through its various developments, made up of sales of user services, paid with interest after use, and development costs, respectively.

We can now use these imputed human capital values to complement the price vector so as to get an imputed price vector, $\bar{p}_t$, with non-zero prices also for human capital.

With the help of this price vector we can now define a net national income in period t, NNI_t as follows:

$$(6.4) \qquad NNI_t = \sum_j (v_{jt} - v_{jt-1}) + \sum_i (\bar{p}_t \bar{k}_{it} - \bar{p}_{t-1} \bar{k}_{i,t-1}) + \sum_i p_t c_{it}$$

The meaning of this can also be expressed as:

NNI_t = Wealth formation + Consumption

The first term on the right-hand side of (6.4) denotes the change in total stock values of the production firms, while the second represents the corresponding change in value of the total stock of capital goods. This last expression can also be developed in the following way:

$$(6.5) \qquad \sum_i (\bar{p}_t \bar{k}_{it} - \bar{p}_{t-1} \bar{k}_{i,t-1}) = \sum_i \bar{p}_t (\bar{k}_{it} - \bar{k}_{t-1}) +$$

$$+ \sum_i (\bar{p}_t - \bar{p}_{t-1}) \bar{k}_{t-1}$$

The wealth formation in capital goods can thus be split up into two parts: change in the physical volume of capital goods and change in capital prices, i.e. what is usually called capital gains.

Contrary to usual accounting practices, the income concept defined here includes wealth formation also in human capital and capital gains for all capital goods. This seems natural when, as here, we are especially interested in tracing the effects of changes in human capital. It means, however, that part of the measured income changes will materialize as actual purchasing power for the households and their holding companies only when future yields are realized and future dividends paid out. The social wealth concept used above, made up of the stock value of firms and the value of capital goods including human capital, can be derived as the discounted value of all future dividends, all future net incomes or all future consumption. This has already been demonstrated for stock values and dividends and has been defined for human capital. That it is also true for other capital goods depends on the fact that their services in the model are assumed to be sold at a given market price, so that any "producer's surplus" will not affect the value of capital goods for the owners, but will instead be registered in the firm dividends. The net national income can therefore alternatively be introduced as the interest on this social wealth.

If we compare the definitions of NNI_t and GNP_t we see that gross investment in the product is replaced by wealth formation in the income concept.

To simplify the subsequent discussion let us assume constant returns to scale in production, which means zero dividends for the production firms. This is indeed a very natural assumption in this model, where the firms have no durable capital of their own.

The difference between gross investment and wealth formation in the holding companies is not entirely due to physical consumption or potential deterioration of capital goods used in production. There are two other factors involved, one of which is capital gains. The other is the fact that when it comes to real estate and human resources there is no given relation between the cost of a certain development service and the value of its impact on the capital employed. Training opportunities offered by a production process may e.g. be of great value to employers of a certain type and state although they are only charged the common market price, which may be insignificant.

We can go on to define gross profits in a similar way. Profits in the production firms will equal dividends, i.e. are zero according to the assumption made earlier. If we consolidate the rest of the economy into a household sector to eliminate loan transactions imputed gross profit for this sector in period t, $\bar{\Pi}_t$, is then defined as:

$$(6.6) \qquad \bar{\Pi}_t = \sum_i \{ (1+r_t) p_t \, k'_{it} - p_{t+1} \, \dot{k}_{i,t+1} \} + \sum_i \bar{p}_{t+1} \, k^+_{t+1} - \sum_i \bar{p}_t \, k^-_t$$

The expression on the right-hand side is made up of three terms, each summed over all households. The first profit term designates rentals, i.e. the net payment received from the firms for services plus the value of household consumption of leisure and real estate services. The second is the value of output capital and the third denotes the value of input capital. The word "imputed" refers to the fact that imputed value changes in human capital have also been included. If we take into account the interest cost involved in holding the input capital over one period we get the imputed net profit, $\bar{\pi}_t$:

$$(6.7) \qquad \bar{\pi}_t = \bar{\Pi}_t - r_t \sum_i \bar{p}_t \, k^-_t$$

The imputed gross profit rate in period t, ρ_t, can be written as:

$$(6.8) \qquad \rho_t = \frac{\bar{\Pi}_t}{\sum_i \bar{p}_t \, k^-_t} = \frac{r_t \sum_i \bar{p}_t \, k^-_t + \bar{\pi}_t}{\sum_i \bar{p}_t \, k^-_t}$$

It follows directly from this definition that if net imputed profit is zero, $\rho_t = r_t$.

Applied separately to human capital this simply expresses the trivial relation that if income from human resources including increases in capital values is just enough to cover current interest on incoming human capital then the imputed gross profit rate for human capital will also be equal to this current rate of interest.

The concepts discussed so far are all total or average. Marginal concepts can be dealt with more conveniently if we assume for the time being that the transformation possibilities of the holding companies can be expressed by differentiable functions. If we also add the harmless assumption that capital services supplied have as their unit of measurement the services of one unit of the corresponding capital good, the transformation possibilities can be written as:

$$(6.9) \qquad k'_t = Mk^-_t$$

$$(6.10) \qquad k^+_{t+1} = f(k_{t+1}, k^-_t)$$

(6.9) states that user services supplied in period t constitute a linear function of incoming stocks of capital goods. The quantity of user services of a capital good in state β is simply the total number of capital goods in this state summed over all types α. M here thus stands for a quadratic matrice of order U x U, where each row corresponding to a component of k'_t measuring user services of goods of a certain state has 1:s in all the places which measure capital goods of this state, while the rest of the matrice is made up of zeros.

(6.10) says that outgoing capital is a function of incoming capital and development services. Both these functions are then assumed to be differentiable. This is certainly not strictly the case, since it is a fundamental property of capital goods as defined here - and particularly of human beings - that they can only change as a unit. Our excuse for using this assumption here is the usual one employed by economists; aggregates may be taken to be large enough and, anyhow, discontinuities do not seem pertinent to the analysis.

We also abstract from the fact that the second function can be multi-valued due to the possibilities of different assignments of development services to the various capital units, i.e. we assume a given assignment rule that makes it possible to trace an expansion in a unique fashion.

If we differentiate (6.9) and (6.10) we get:

$$(6.11) \qquad dk'_t = Mdk^-_t .$$

$$(6.12) \qquad dk^+_{t+1} = f_{\dot{k}}\, d\dot{k}_{t+1} + f_k dk^-_t$$

If we take the price vectors $\bar{p}_t$ and $\bar{p}_{t+1}$ as given there are

then two possibilities of marginally affecting profits and profit rates - by changing incoming capital and by changing the investment in development of real estate and human resources. Let us look at these in turn.

Marginal changes in incoming capital cannot be made in human resources, which at each point in time are given and non-tradable. With this restriction in mind we can define the marginal change in imputed gross profit resulting from a marginal change in incoming capital as:

$$(6.13) \qquad d\bar{\Pi}_t = \sum_i \left[(1+r_t)\, p_t\, M + (f_k \bar{p}_{t+1} - \bar{p}_t) \right] d\bar{k}_t$$

If no development service is reassigned to the new capital we can neglect f_k and gross profits will change due to change in user charges and in the volume of capital gains. But we also know from differentiating (6.7) that:

$$(6.14) \qquad d\bar{\Pi}_t = d\bar{\pi}_t + r_t \sum_i \bar{p}_t\, d\bar{k}_t$$

Since we are studying an equilibrium point where net profits will be maximized along with dividends, marginal net profit is zero which obviously means that the marginal profit rate will equal the rate of interest. This is what we usually expect to find in equilibrium models, that is:

$$(6.15) \qquad d\rho_t = \frac{d\bar{\Pi}_t}{\sum_i \bar{p}_t\, d\bar{k}_t} = r_t$$

If instead we study a change in development investments in real estate and human resources, the corresponding change in imputed gross profits will be:

$$(6.16) \qquad d\bar{\Pi}_t = \sum_i \{ \bar{p}_{t+1} f_k' - p_{t+1} \}\, d\dot{k}_{i,t+1} =$$

$$= \sum_i (\bar{p}_{t+1}\, d\dot{k}^{+}_{i,t+1} - p_{t+1}\, d\dot{k}_{i,t+1}) = 0$$

That the change in profit must, in equilibrium, equal zero follows from (6.14) above. Not only must marginal net profit again be zero but this is now also true of the second term in (6.14), the change in interest on incoming c[illegible]. Applied to human investments, (6.16) states that the v[illegible] marginal investment in equilibrium will equal its cost. [illegible] follows that the marginal profit rate is also zero:

$$(6.17) \qquad \frac{d\bar{\Pi}_t}{\sum_i p_{t+1}\, d\dot{k}_{i,t+1}} = 0$$

This may at first seem more surprising, as it means that e.g.

the marginal rate of profit on investments in human capital is zero. This, however, is merely a consequence of the fact that in the model we assume such investments to change the human capital immediately without any costly delays. Here we have also let these investments affect the imputed gross profit directly by way of the imputed capitalization of future increases in human rentals. If we rewrite (6.16), substituting from (6.3) above the full definition of imputed capital value, we get:

$$(6.18)\qquad \sum_i p_{t+1}\dot{dh}_{i,t+1} = \sum_i dh^{+}_{i,t+1}\left\{\frac{1}{\beta_{t+1}}\sum_{\tau=t}^{\infty}\beta_{\tau+1}(1+r_\tau)p_\tau h^{**}_\tau - p_{\tau+1}\dot{h}^{**}_{\tau+1}\right\}$$

where h^{**} as before traces the various states of each original unit of human capital. The expression within brackets on the right-hand side simply measures the discounted value of future human rentals or, what amounts to the same thing, the discounted value of future profits on human capital - without imputation of human capital values. The meaning of (6.18) can therefore be written simply as:

The cost of a marginal human investment =

The discounted value of the future marginal profits which result.

The rate of return of marginal human investments, defined as the internal yield rate, will then in equilibrium depend on the spacing of future marginal profits and on the sequence of interest rates involved. Specifically, if the rate of interest remains constant over the future, the marginal rate of return on human investments will equal this interest rate just as it will for other kinds of investment; see (6.15) above.

2 Homogeneity of human capital

2.1 The need for further assumptions

What we have shown in the first chapter is simply that the human capital concept can be incorporated in a general equlibrium context in a way similar to what is done with other factors of production and that it can also be fitted into a social accounting matrix.

We have traced the accounting relations between the financial concept of human capital value and the rentals or earnings of human resources. Human capital in this sense may be a conveniance for social accounting and a shorthand notion for discussing individual expectations.

The reason for using a "human capital approach", however, is usually much more ambitious. One hopes in this way to arrive at some testable relation between the volume of human investments in an individual and his or her earnings, possibly with some capability factor as an intermediate variable.

From this point of view our general equilibrium model is far too general. All we can generally say about the wage of an individual, i.e. his user charge in the model, is that it depends on his state, which in turn depends both on what type of person he is and on how much has been invested in him - assuming that the investments have been optimal. His human value is thus partly accounted for by investments done and partly by his type rent, i.e. the value of his development potential. In principle we could try to separate the two components by measuring at birth the discounted value of all future rentals until death - his individual type rent value which then also incorporates various surpluses in human investments. But we cannot measure either total rent or differential rent separately later on in life. Since people are assumed to be fundamentally different - to belong to different types and not just more or less capable - they will usually be found chosing different careers. The relative remuneration of these careers may well change with demand and supply conditions over time. In the same way the relative costs of various forms of human investments will vary and will not generally be proportionate to their relative value. In one respect, however, the model is better tailored to the needs of human capital theories than real life. In the model pure wages and human investments are accounted for separately, while in real life, we can usually only determine the total rentals for various kinds of jobs.

In order to derive the kind of simple relations between the volume of human capital in some sense and the individual earnings that human capital theories often aim at, the model must obviously be restricted and further specified in several ways.

By stepwise restricting and modifying our model, we will in the following try to approach the kind of human capital theory model needed to "explain" the relative structure of current earnings.

2.2 The first assumption: Physical human capital and the possibility of aggregation

One main assumption inherent in a "pure" human capital theory is that relative earnings depend only on the physical capital, the "earning potential", embodied in the individuals. Let us for the time being keep this assumption as general as possible, still allowing e.g. for a possible heterogeneity of this physical capital. If we call the price component for the i'th state of human capital w_i, which then measures the wage or user charge of an individual in state i, the assumption could be formally expressed as:

$$(2.1) \qquad \frac{w_i}{w_j} = f(h)$$

where we for notational conveniance assume that the relation is a differentiable function.

What (2.1) states is then that the relative wage is a function only of the vector of human resources used. The relative wage is thus unaffected by changes e.g. in production capital, in cooperating real estate, in output mix or in the rest of the equilibrium price vector.

Let us reflect for a moment on what this requirement means in terms of our MGE-model. There we had human resources of various types and states and we assumed that earnings were only related to states. To fit into the assumption discussed here we must then first of all accept that all human resources in the same state, regardless of type, embody the same physical human capital. The distribution between states of embodied capital then determines relative earnings.

Even if the human capital is heterogeneous we cannot explain changes in relative earnings by reference to changes in relative capital prices, as we do in dealing e.g. with machines. There are no capital markets for human resources and any attempt to bring in changing imputed capital prices for various kinds of labor would obviously rob the physical,human capital concept of any explanatory power and bring us back to the starting point, i.e. to the financial concept of human capital value as a discounted sum of future earnings.

The quotient of wages in (2.1) expresses in equilibrium the marginal rate of substitution between the two kinds of factors, i.e. between human resource units of states i and j. The assumption of (2.1) can therefore equally well be expressed in the following manner. The marginal rate of substitution between two kinds of labor should be independent of everything except the amounts of labor inputs.

If we simplify the model to account only for a vector of production capital q, two kinds of labor inputs h_i and h_j and a homogeneous output C, the condition can be more directly stated as follows. "The marginal rate of substitution between the two labor inputs is independent of the output level and the vector of production capital".

In this form the condition is known as the Leontief condition (Leontief, 1947) and expresses a necessary condition for aggregating the two inputs. We can then call our condition above a "generalized Leontief condition" and have as an hypothesis that this condition also expresses a necessary aggregation condition. Let us try briefly to follow up this idea.

In our model we have represented production possibilities as point sets. Let us for illustrative purposes use a simplified form of such a set T with elements of the form (h, q, c) where h still stands for a vector of labor inputs, q for a vector of production capital and c for a vector of output goods.

Aggregation of h in terms of such a model simply means that there exists a well-defined function ϕ, which relates h to a scalar, an aggregate, H: $H = \phi(h)$, and which possesses the following property:

There exists a set T_a with elements (H, q, c), such that $(H, q, c) \in T_a$ if and only if $(h, q, c) \in T$.

(For a more extensive discussion of meanings of aggregation the reader is refered to Fisher (1965), Morishima (1961) and Bliss (1975)).x)

That the Leontief condition is a necessary condition for aggregation can easily be seen in the following way. Let us write the differentiable production function as: $C = P(q, h)$. If we

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x) The meaning of this can perhaps be better grasped intuitively if expressed in an alternative way.

For every possible collection of production capital, q, and output, c, in T there is paired a set of possible combinations of labor inputs, $\{h \mid (h, q, c) \in T\} = S_h$. Seeking an aggregating function then means we are looking for a way of ordering these sets S_h in a linear way so that each set can be assigned a unique number H. This is obviously only possible if a complete (and continuous) order is already established between the sets by inclusion, i.e. if the sets are such that either $S_{h_i} \subseteq S_{h_j}$ or $S_{h_i} \supseteq S_{h_j}$. A collection of sets S_h ordered in this way is said to be nested.

The definition of aggregation given above can also be shown to be equivalent to the following condition (for proof cf e.g. Bliss (1975)):

The sets S_h are nested.

substitute the aggregate $H = \phi(h)$ in this function we get $C = P(q, H)$. The marginal rate of substitution between two kinds of labor becomes:

$$(2.2) \qquad \frac{w_i}{w_j} = \frac{P_H \cdot \phi_i}{P_H \cdot \phi_j} = f(h)$$

where P_H and ϕ_i represent partial derivatives with respect to H and an i state component of h, respectively.

As long as we can reformulate our model in terms of differentiable functions this demonstration can obviously easily be extended to encompass our generalized version of the Leontief condition.[x)]

The concrete meaning of our generalized Leontief condition is easily spelled out. It is obviously a very strong assumption that is only fulfilled in some very special theoretical cases and almost certainly never in real life.

One such case is of course the case of perfectly homogeneous labor, an infinite elasticity of substitution between any two states of human capital.

Another case exemplifies the opposite, with fixed coefficients for different kinds of labor - an elasticity of substitution equal to zero.

A possible third theoretical case would be when labor is already aggregated in real life by being organized in "labor companies" that offer for sale a homogeneous intermediate labor service.

These examples suffice to indicate the strength - and lack of realism - of the assumption.[xx)]

x) It should perhaps be pointed out that here we have treated aggregation conditions in the most general form, which is motivated by our aim of applying the conclusions also to our very general MGE-model. Had we narrowed our attention only to stationary equilibria the aggregating conditions would have been formulated in a different way, stressing not only the difficulties in establishing a linear order but also the problem of doing so in such a way as to preserve functional relations in the aggregate. This is best exemplified by the discussion, wellknown in capital theory, of the possibility of establishing meaningful chain-indices for capital goods between different stationary equilibria. (See e.g. Champernowne (1953-54) and Bliss (1975)).

xx) If we want to restate the assumptions in terms of a stationary model version (see note at the end of the chapter), it should be observed that the assumption does not require the wage structure to be constant between stationary equilibria. This would be the case if human capital were really "non-reproducible". As it is the wage structure may change between equilibria, not as a direct consequence of other changing equilibrium prices, but indirectly via induced changes in the composition of different states of human capital.

2.3 The second assumption: Homogeneous human capital

The first step towards restricting our model only established that the earning capacity for an individual in a certain state is somehow physically embodied in the individual. This obviously does not take us much further when it comes to finding a uniform explanation for the relative earnings. We have only as it were moved the problem to be explained one step backwards, into the physical character and productivity of the various individuals.

Since it is not the aim of human capital theories to provide explanations of physical differences in productivity between different individuals, the next step to be taken is obvious. We must also assume that human capital is homogeneous, i.e. that any two units of human capital have an infinite elasticity of substitution. This means that the human capital of different individuals, h, can not only be aggregated to H but also measured with the same measuring rod, i.e. in units of H.

When all human capital is one and the same, its distribution between individuals does not matter, by definition (we abstract here from indivisibilities). In (2.1) the wage quotient depended on the variable composition of the human capital stock. With homogeneous capital this functional relation must be constant, determined by the given human capital values, H_i and H_j, of the respective states of human resources.

$$(3.1) \qquad \frac{w_i}{w_j} = f(h) = g\left(\frac{H_i}{H_j}\right) \quad \text{x)}$$

We have so far only dealt with what homogeneous human capital is, without explicitly saying anything about how it is formed. Our MGE-model provided a very general description of human investments in terms of "development services", $\dot{h}$. If we assume that the possible transformations of human capital can be represented separately in functional form, the process described in the model for human capital formation can be written as:

$$(3.2) \qquad H_t = \psi^{\alpha}(H_{t-1}, \dot{h}_t) = H_o^{\alpha} + \psi^{\alpha}(\dot{h}_1, \ldots\ldots, \dot{h}_t)$$

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x) In studying a linear stationary equilibria we can make this statement more precise. We then know that net rentals on all capital will just pay the interest costs on the capital values. (3.1) thus becomes:

$$\frac{w_i}{w_j} = \frac{raH_i}{raH_j} = \frac{H_i}{H_j}$$

where a represents some given unit price of human capital.

(3.2) says that for an individual of type α his amount of human capital at time t is a function of both his human capital in the preceding period and the development service, the human investment, that he has absorbed since then. This recursive formula can equally well be rewritten, as is done at the end of (3.2), in terms of an initial type capital, H_o^{α}, and a function of the series of investments up to time t, that measures what we can call the investment-induced capital.

2.4 The third and fourth assumptions: Homogeneity of human investments and the ordering of human types

By means of our two successive restrictions we have now arrived at the concept of a homogeneous human capital, whose actual amount determines the state and through that, also the earnings of an individual. Is this then enough on which to build a general and applicable economic explanation of relative earnings? To see that the answer to this question is still no, it suffices to look at the expression in (3.2.) above.

To determine the amount of human capital and, in turn, the earnings of an individual we must obviously know a) what type of individual he or she is b) what the exact form of the functional relationship in (3.2) is for this type and c) what kind of experiences the individual has had and in what order. This is a rather big order, certainly too big for anyone aspiring to reach a simple and unified explanation in economic terms. Since we assume here that this is the aim of the pure human capital theory we must introduce further restrictions.

One first such restriction must deal with the various kinds of human investments. It does not help us to know that the human capital, which is inaccessible for direct measurement, is homogeneous if there are any number of heterogeneous inputs that can produce this capital. We would then need exact knowledge of the effect of each of these on human capital production. The only assumption that will let us escape from these difficulties is the assumption of homogeneous human investments. We assume in other words that we can treat the h as homogeneous, measurable and aggregable in terms of scalar H, in the same way as we assumed human capital, the h, to be homogeneous. It must be fully homogeneous, not just possible to aggregate in the production function, since we also need to be sure that the order of investments over time can be neglected.

With this assumption (3.2) can be rewritten as:

$$(4.1) \qquad H_t = \psi^{\alpha} (\dot{H}_t)$$

where $\dot{H}_t$ measures the sum of human investments for an individual of type α up until time t.

The usual empirical interpretation of the assumption is of course that the collection of investments in an individual can be measured by the sum of discounted investment costs.

However, there is still a major obstacle left before we can arrive at a unified explanation. As long as the functional relations, ψ^{α}, are left wholly unspecified, we could still have heterogeneous people even though both human capital and human investments are assumed homogeneous. If the set of functions, ψ^{α}, differ between themselves in many ways, e.g. in many functional constants, people of different types will be heterogeneous in that their differences cannot be measured by any one scalar. We would then still have to make specific estimations of the function for each type, which would usually require more information and other kinds of information than we have available to us.

To explicitly exclude this possibility we must assume that the functional relations, the "production functions for human capital", are the same for all types only differing in one "type constant", say α. This means we now assume that (4.1) can be written:

$$(4.2) \qquad H_t = \psi(\dot{H}, \alpha)$$

α can be said to represent some uni-dimensional measure of capability. People may be more or less capable but they are otherwise the same. To give capability an unambiguous meaning one should also add the further assumption that given the same volume of human investments, a more capable person is always a better prospect for further investments. This is analogous to the natural assumption that human investments always have a non-negative yield. These two assumptions may be written as:

$$(4.3) \qquad \psi'_{\alpha} \geq 0$$

$$\psi'_{\dot{H}} \geq 0$$

By means of these last assumptions we have finally restricted our model to the point where it can be said to yield a unified explanation of relative earnings in terms of embodied human capital. "All" we have to do - if we believe in the explanation - is to try to estimate the ψ-function and measure the capability of various individuals on some scalar scale.

We certainly cannot claim that all so-called human capital theories are based on these assumptions. What we can claim is that those theories that have the stated explanatory goal and are conceived within the context of a general equilibrium must make these, or analogous, assumptions. Our guess is that this covers a major part of the literature on human capital theory.

A note on stationary equilibrium

The MGE-model is somewhat unwieldly for serving as an example and frame of reference. Instead of using a general intertemporal equilibrium it is sometimes more convenient to formulate the problems in terms of a comparison between different stationary equilibria, all possible within the given technology but with different equilibrium prices.

This also makes the empirical interpretation easier since in a stationary model you can avoid the difficulty of having to separate wages from net human investments.

In principle you could attain the same advantages by using, instead of a stationary model, a model with semi-stationary growth, i.e. a model where all inputs and outputs keep expanding proportionately at a given rate.

However, this procedure is not open to us since we have explicitly incorporated real estate into our model and have defined types of real estate in terms of given and unchangeable characteristics of land. With our broad interpretation of real estate it would make even less sense than usual to make use of economists' worn-out excuse that land expansion is to be interpreted as a land-augmenting but otherwise neutral technical progress.

Since we are no longer interested in tracing individual investments in human resources we can simplify by reverting to the more traditional institutional arrangements, splitting up the holding companies so that produced capital goods are managed by the production firms while the human resources and real estate are held directly by the households. We may also treat the collection of firms as if it were only one maximizing unit, since the production technologies of the firms add up to the total production plan for the economy, which will maximize profits only if this is true of each component firm.

The equilibrium being stationary there will be no net investment in human resources or in any other kind of resources, which means that in the aggregate, from the firm's point of view, we can treat human resources and real estate as if they were unaffected by production and compensated only by user charges paid when production matures after one period.

For notational convenience we can further partition the price vector p into separate vectors for consumption, and for various factors of production. This means that we treat the same commodity appearing both in consumption and as production input as two separate commodities.

With these modifications the transformation taking place in the firms can then be expressed as the following pair of inputs and outputs, being one of the many possible trans-

formations included in the, once and for all, given set of production possibilities, T:

(1) $\{(0, q, e, h), (c, q, 0, 0)\} \in T$

where q stands for producer inputs, e for real estate, h for human capital and c for consumption.

What (1) says is then simply that, with the help of the "non-producible" factors, real estate and human resources, a given vector of production capital reproduces itself and also leaves a consumption surplus. This is the production cycle that is assumed to repeat itself during each period in the stationary equilibrium.

Another common way of characterizing the stationary equilibrium is to write down the expression for aggregate firm profit. With the use of the partitioned price vector the profit expression will appear in the following well-known format:

(2) $\Pi = p_c c - rp_q q - p_a e - p_w h$

$p_c c$ here represents the income from consumption sales, $rp_q q$ is the interest cost of holding stocks of production capital, while $p_a e$ and $p_w h$ represent rentals for real estate of different kinds and for human resources, respectively, both measured at the time of payment.

This all sounds so familiar that it may be well to remind the reader of some aspects of (2), due to its derivation from the more general model, which make it still somewhat special.

Real estate and human resources here are "non-producible" only as to type but not as to state. Since state is what matters in production, there is still a large, although restricted, choice between alternative distributions between states, reachable within the given technology by way of investments in development.

Secondly we cannot claim here that equilibrium prices will be uniquely determined by the chosen technological transformation. Much of the recent discussion around stationary models has assumed that prices are not dependent on demand and these assumptions have been formalized into various so-called non-substitution theorems. However, there can never be a unique equilibrium price independent of demand if there is joint production of goods that have to face different demands. This is certainly the case in our MGE-model, where development services were specifically defined in terms of a joint production process.

(2) can be still further simplified. Although linearity or constant returns to scale is not a necessary concomitant of stationarity, it is rather hard to find plausible excuses for

not making this assumption. Therefore in the following we assume $\Pi = 0$.

The competitive conditions in equilibrium can now be expressed in a straightforward way.

Since we are dealing with a competitive equilibrium we know that the chosen transformation is more profitable than any other possible transformation at the given equilibrium prices. If we call this transformation number one and number the variables accordingly, we have

$$(3) \qquad \Pi^1 = p_c^1 - r^1 p_q^1 q^1 - p_a^1 e^1 - p_w^1 h^1 = 0$$

If we compare this with an alternative transformation called number two, the condition of competitive equilibrium ensures that:

$$(4) \qquad p_c^1 c^2 - r^1 p_q^1 q^2 - p_a^1 e^2 - p_w^1 h^2 \leq 0$$

If we subtract (3) from (4) and define $\Delta y = y^2 - y^1$ where y is any vector of values we get:

$$(5) \qquad p_c^1 \Delta c - r^1 p_q^1 \Delta q - p_a^1 \Delta c - p_w^1 \Delta h \leq 0$$

Already from this restatement of competitive conditions we notice one main difference from the usual discussions in capital theory. There it is assumed that non-produced factors are strictly non-producible which means that Δe and Δh in (5) are both equal to zero and that we can continue to study in isolation e.g. the impact of capital intensity on consumption standards. When investments in human resources and real estate are brought in as here, the discussion has to be broadened to deal also with changing patterns in these kinds of capital.

When human capital is homogeneous we can use the aggregate directly in reformulating the profit expression for our stationary equilibrium (cf (2) above).

$$(6) \qquad p_c c - r p_q q - raH - p_a e = 0$$

If we want to illustrate how human capital theory impinges on the controversial issues in capital theory, this can easily be done with (6) as a starting point.

Let us make all the simplifying assumptions that were used earlier in the more "naive" discussions of capital theory. This means that on top of our earlier assumptions we now also assume that a) consumption and produced capital can also be treated as aggregates and represented by C and Q and b) no land is needed in production, i.e. all components of e are equal to zero. (6) then reduces to:

(7) $C - rbQ - raH = 0$

where b represents the unit price of produced capital. If we now compare two alternative equilibria, using the competitive condition, as in (5) above, we arrive by successive subtracting to the following condition:

(8) $\Delta (rb)\ \Delta Q + \Delta(ra)\ \Delta H \leq 0$

where, as before, $\Delta(rb) = r^2b^2 - r^1b^1$, etc.

In the usual capital theory discussions, labor resources were assumed given and unchangeable, i.e. $\Delta H \equiv 0$. (8) can then be interpreted as expressing the well-known notion that "a stationary state with a higher level of capital relative to non-produced factors cannot have a higher rental of capital in terms of consumption".

Here, with $\Delta H \neq 0$, i.e. with possibilities for human investments, the interpretation of (8) becomes somewhat more complex. The condition now states that "if a stationary state with higher level of produced capital also has a higher rental for this capital, then the resulting cost increase must be at least compensated by either a decrease in human capital or a lowering of the rental on this capital".

Since this whole line of reasoning presupposes uninhibited aggregation throughout it does not really merit much interest. As is well known one outcome of recent controversies in capital theory has been a rather general agreement that an over-all-aggregation of produced capital is never theoretically justifiable. There is an irony in the fact that human capital theory, building on aggregating conditions, matured and was turned into applications at the very time that agreement was reached on the impossibility of capital aggregation in general.

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